



New Bedford Whaling National Historical Park *Alternative Transportation Systems Evaluation and Analysis*



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John A. Volpe National Transportation Systems Center
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Introduction

During the mid-19th century, New Bedford was the whaling capital of the world. Congress established New Bedford Whaling National Historical Park in 1996 to commemorate the American whaling industry and its contribution to our nation's history. The park represents a new model in the National Park Service (NPS): preservation and education are achieved through partnerships and not through federal ownership. Other than the Visitor Center and the Corson Maritime Learning Center, the NPS does not own any property or buildings. Together, park partners preserve New Bedford's historic landscapes, structures, and collections and promote research and educational programming associated with the history of whaling. Core partners include the:

- City of New Bedford
- Rotch-Jones-Duff House and Garden Museum
- New Bedford Whaling Museum
- Waterfront Historic Area League (WHALE), an historic preservation association
- New Bedford Port Society (owns Seamen's Bethel and Mariner's Home)
- The Massachusetts Department of Conservation and Recreation (owns the Schooner Ernestina)
- New Bedford Historical Society (owns the Nathan and Mary Johnson properties)

The park's 2001 General Management Plan (GMP) recommends working with the City of New Bedford to provide public transportation between the waterfront, park/partner sites, and parking areas: "The National Park Service will work with the city of New Bedford to expand shuttle bus service to provide public transportation between parking areas and a number of downtown destinations—including the historic district—and to provide service to the waterfront as well as to the Rotch-Jones-Duff House and Garden Museum during the visitor season." Such a shuttle service would increase visitation to outlying park sites, better connect the park to the waterfront, maximize visitor safety by providing safe transportation to parking areas, and decrease on-street traffic and parking by encouraging visitors and residents to park in the garages or leave their vehicles at home campus.

Project overview

In 2008, the New Bedford Economic Development Council (EDC), the New Bedford Harbor Development Commission (HDC), and the University of Massachusetts (UMass) Dartmouth partnered to pilot a shuttle service that runs between the ferry terminal, the downtown, and a satellite parking area for ferry passengers during the spring, summer, and fall and a loop (termed The LOOP) to UMass Dartmouth for students, faculty, and staff in the fall, winter, and spring months.

The park has proposed a phased approach to result in an alternative transportation shuttle system that will directly link park sites with parking facilities, ferry and cruise ship service, and other destinations for visitors during different seasons:

- Phase 1 proposes evaluating the existing shuttle currently piloted by the EDC, HDC, and UMass Dartmouth.
- Phase 2 includes instituting a shuttle pilot with service for park visitors over three years with an evaluation in the third year.
- Phase 3 includes the purchase of accessible alternative energy shuttle vehicles, installation of shuttle stop kiosks and signage, and launch of a regular shuttle service.

The NPS asked the U.S. Department of Transportation John A. Volpe National Transportation System Center (Volpe Center) to conduct work in line with Phase 1. This report evaluates the existing pilot shuttle and determines the feasibility of establishing a shuttle system to serve visitors to city cultural sites, the ferry terminal, and adjacent parking areas. This evaluation assesses the sustainability of a park shuttle service including potential shuttle routes, revenues and expenditures, operating costs, and financial and operational partnerships.

Overview of the City of New Bedford

New Bedford, Massachusetts, is located roughly 50 miles south of Boston and 30 miles east of Providence, Rhode Island. The city is the seventh largest populated city in the Commonwealth with a total population of 91,849ⁱ, though population has been declining since the height of the textile industry in the 1920s. Originally founded by Protestants of English, Scottish, and Welsh origin, New Bedford experienced rapid growth of Irish immigrants in the early 1800s, Portuguese and Cape Verdean immigrants during the height of the whaling industry (1750-1900), and Polish and eastern-European Jewish immigrants in the early to mid 1900s. Following industrial successes in the whaling (1750-1900) and textile (1880-1930) industries, New Bedford's current economic drivers are commercial fishing, manufacturing, healthcare, and tourism. As of 2007, commercial fishery landings at the Port of New Bedford (Figure 1) had the highest annual dollar value of catch in the country with \$268 millionⁱⁱ.

Figure 1
Section of the Port of New Bedford.

Source: The Volpe Center



Several annual weekend events, including Summerfest, an international folk music and arts festival, and Feast of the Blessed Sacrament, the largest Portuguese feast in the world, attracted roughly 35,000 and 100,000 visitors, respectively, in 2008. The Working Waterfront Festival, occurring in late September, is an opportunity for visitors to tour fishing boats and learn about the commercial fishing industry. AHA! nights are free downtown cultural nights to promote and sustain the arts in New Bedford. An effort by downtown New Bedford to establish itself as a regional economic and cultural hub, AHA! nights occur the second Thursday of each month. AHA! includes over 42 venue partners downtown.

The city is actively pursuing development in the downtown and surrounding areas through a variety of neighborhood planning efforts, historic mill renovations, and policies tailored to promote creative economies and small businesses. With the help of individuals, community organizations, private industry, and the NPS, New Bedford is leveraging its social, historical, and industrial assets to boost economic growth in the city.

Park location

The New Bedford Whaling National Historical Park is located in downtown New Bedford along the west bank of the Acushnet River. The park is largely contained within 34 acres in the New Bedford Historic District, a 13 city-block area located adjacent to New Bedford Harbor. Within the park boundaries are 70 properties, many of which are held by its core partners. As shown in Figure 2, the historic park boundary is defined by State Route 18, a four-lane highway, on the east; Union, School, and South Water Streets on the south; Acushnet Avenue on the west; and U.S. Route 6 on the north.

Figure 2
Downtown New Bedford and New Bedford Whaling National Historical Park.

Source: NPS



Some of the park's attractions are spread out beyond the park boundary. Attractions along the waterfront include the Schooner Ernestina (located at the southwest corner of State Pier), Waterfront Park (located south of State Pier), the Wharfinger Building (which is the city's visitor center where the park has a display), and the Bourne Counting House (currently not open to the public). Attractions outside of the downtown include the Nathan and Polly Johnson Properties (currently not open to the public) and Rotch-Jones-Duff House and Garden Museum. The most outlying attraction, the Rotch-Jones-Duff House and Garden Museum, is located three quarters of a mile from the waterfront historic sites.

Core partners and attractions

The enabling legislation for New Bedford Whaling National Historical Park authorized the Secretary of the Interior in 1996 to enter into cooperative agreements to preserve, develop, and interpret the parkⁱⁱⁱ. Partners with a formal legislated connection or cooperative agreement with the park are identified in the park's GMP. Brief descriptions of the partners and attractions are provided as follows:

- *New Bedford Whaling National Historical Park Visitor Center* – The Visitor Center (Figure 3, left) and the adjoining Corson Maritime Learning Center make up the only property within the 34-acre park owned by NPS. The Visitor Center building is a former bank built in 1853 and features exhibits, a gift shop, and a small theater that plays a 20-minute informational video, *The City That Lit the World*. In July and August, rangers and volunteers offer guided walking tours of the park.

Figure 3

New Bedford Whaling National Historical Park Visitor Center (left) and New Bedford Whaling Museum (right).

Source: The Volpe Center



- *The City of New Bedford* – Several city departments work with the park to maintain and protect its historic resources. The city operates the Waterfront Visitor Center and works with the park to undertake educational projects in the public schools. The park is represented on the New Bedford Historical Commission by a regular member and an alternate and also provides staff to the Commission.
- *Waterfront Visitor Center* – The city-owned Waterfront Visitor Center is located in the historic Wharfinger Building on Fisherman's Wharf, just outside the park boundary. The Wharfinger Building was built in 1934-35 as a federal Works Progress Administration project and was used for years as a fish auction house. Today, the Waterfront Visitor Center features a park exhibit on the contemporary fishing industry in New Bedford.
- *New Bedford Whaling Museum* – The New Bedford Whaling Museum was originally opened in 1907 to house and display artifacts relevant to the whaling industry. Today, the New Bedford Whaling

Museum is the nation's largest museum devoted to the American whaling industry with the largest collections of scrimshaw and whaling vessel log books in the country (Figure 3, right). The museum also maintains a significant collection of fine art and craft by local artisans from the whaling era. The museum hosts popular educational programs for school children.

- *New Bedford Port Society* – Organized in 1830 with the mission of “moral and religious improvement of seamen,” the New Bedford Port Society operates two institutions within New Bedford Whaling National Historical Park: the Seamen’s Bethel and the Mariner’s Home. These buildings, shown in Figure 4, are located next to each other on Johnny Cake Hill across from the Whaling Museum.

The Seamen’s Bethel was opened in 1832 by wealthy Quakers concerned with the spiritual well-being of mariners in New Bedford. The Seamen’s Bethel became famous when depicted as the “Whalemen’s Chapel” in Herman Melville’s 1851 novel, *Moby Dick*. The Seamen’s Bethel is open to the public and is still used for regular services, weddings, funerals, and other religious activities.

The Mariner’s Home was opened for its present use as a home for transient mariners in 1857. Originally built as a private mansion in 1787, the building was later donated to the New Bedford Port Society and moved to its present location. The building is not open to the public, but it continues to provide temporary lodging at a nominal cost for transient seamen.

Figure 4
The Seamen’s Bethel (left) and Mariners Home

Source: The Volpe Center



- *Schooner Ernestina* – Built in 1894 as a fishing schooner, the Schooner Ernestina, shown in Figure 5, is a National Historic Landmark that offers educational trips for students. Other former uses include service as a transatlantic packet (passenger transport ship) carrying immigrants from Cape Verde, Arctic exploration vessel, and World War II survey vessel. The schooner is currently owned by the Commonwealth of Massachusetts Department of Conservation and Recreation and occupies a slip on State Pier. The Schooner Ernestina was donated to the Commonwealth by the people of Cape Verde. In June of 2008, the Schooner was transported to Boothbay Harbor, Maine, for restoration.
- *Rotch-Jones-Duff House and Garden Museum* – The Rotch-Jones-Duff House is located three-quarters of a mile from the park’s visitor center. The house was built in 1834 in the Greek Revival style on what was at the time the most fashionable residential street in New Bedford and was home to three prominent families, all of which were active in New Bedford’s whaling industry. The museum, which occupies an entire city block in the County Street Historic District, was acquired by WHALE and

reopened as a museum in 1983. The park's 1996 enabling legislation names the Rotch-Jones-Duff House and Garden Museum as a core park resource. In 2005, the property was formally designated a National Historic Landmark. The garden on the south side of the house is a major attraction of the museum and reflects, as does the interior of the home, the societal tastes of all three families' respective eras. Like the New Bedford Whaling Museum, the Rotch-Jones-Duff House offers structured educational programs for school children.

Figure 5

The Schooner Ernestina

Source: Schooner Ernestina Commission



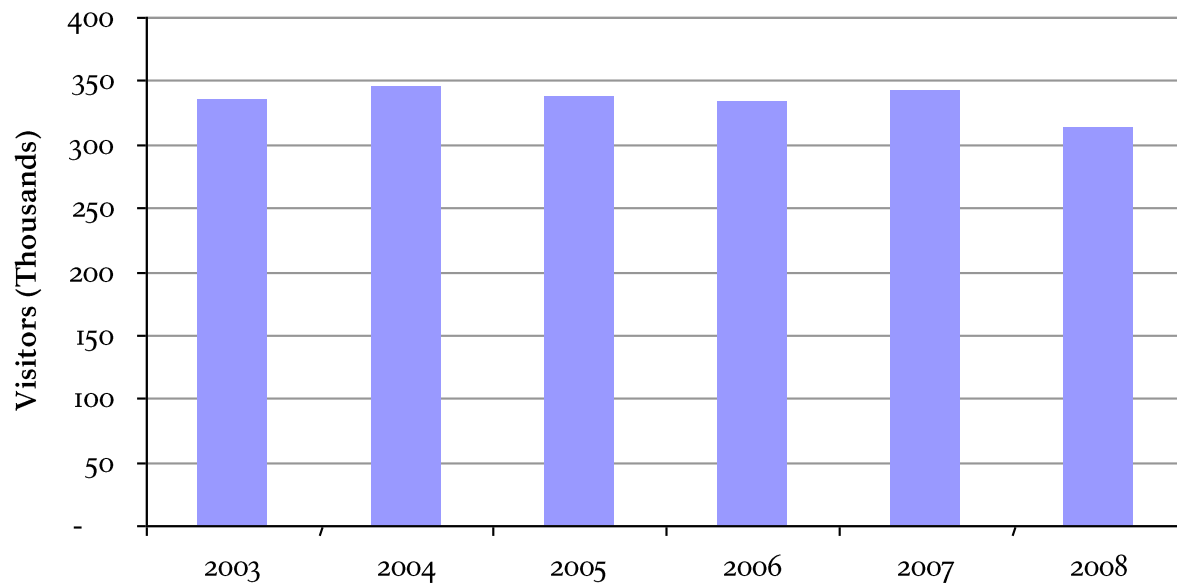
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- *New Bedford Historical Society* – The New Bedford Historical Society is a core partner but has no attractions open to the public. The Historical Society's headquarters is located in the Nathan and Mary (Polly) Johnson properties on Seventh Street outside the park boundary. The properties served as the first home in freedom to Frederick Douglass and are known to have sheltered many escaped slaves as part of the Underground Railroad. The properties were designated a National Historic Landmark in 2000.
 - *Waterfront Area Historic League (WHALE)* – WHALE is a core partner with no attractions open to the public aside from its association with the Rotch-Jones-Duff House and Garden Museum. Established in 1962 to protect New Bedford's neighborhoods from urban renewal and neglect, the organization today is involved in various advocacy, education, and preservation projects. WHALE has also been a partner on many key projects such as the acquisition and stabilization of the Corson Building and redesign plans for Route 18. Aside from their preservation projects, WHALE offers an educational program to third graders in four local elementary schools called "Discovering New Bedford."
 - *Iñupiat Heritage Center* – The Iñupiat Heritage Center in Barrow, Alaska, is linked to the park through the park's enabling legislation as Barrow was an important outpost for New England whalers in the Arctic during the late 19th century. The NPS works in partnership with the center to commemorate the 2,000 whaling voyages to the western Arctic and the contributions of Alaska natives to the enterprise.
 - *Wampanoag Tribe of Gay Head (Aquinnah)* – The Wampanoag Tribe is a federally recognized tribe of more than 800 members that has a historic interest in New England whaling. Ancestors of the tribe were active participants in the whaling industry from the outset. Today the Wampanoag Tribal Historic Preservation Office provides consultation to the NPS on archeological, ethnographic, and programming issues.

Visitation

Each of the park's publicly-accessible partners collects visitation information and sends this information to the park. Annual total visits to all of the park's partner attractions and the park's Visitor Center are shown in Figure 6.

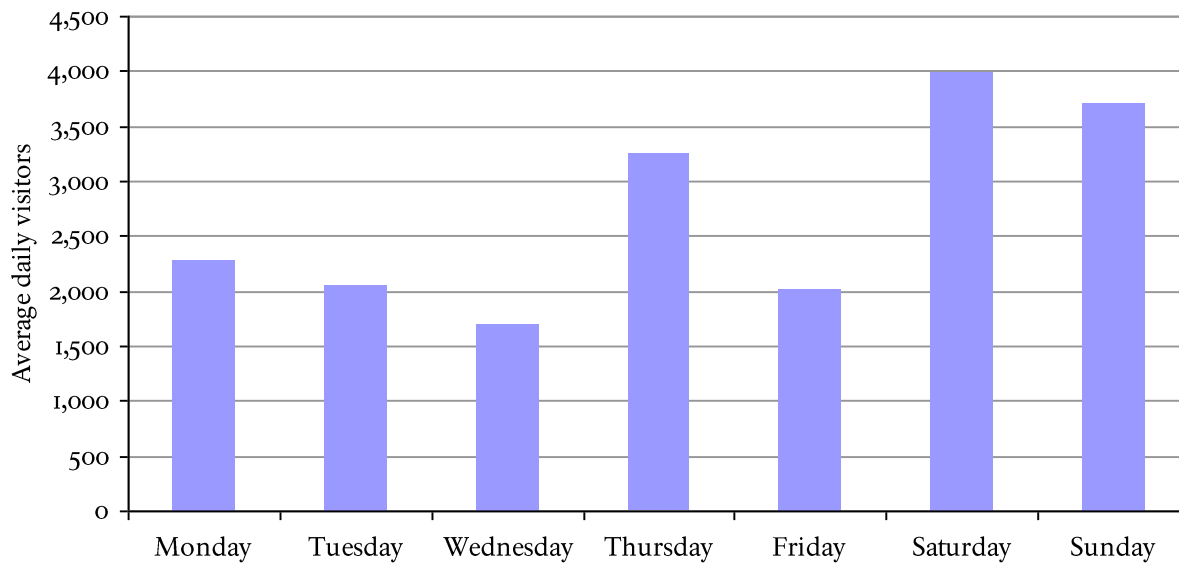
Figure 6
Annual total visits to the park during NPS FY 2003-2008 (NPS FY is October to September).

Source: The Volpe Center using NPS data



Average daily visits to the park and its publically-accessible partners from July through September 2008 are shown in Figure 7. High visitation levels on Thursdays are due to city programs in which the park participates, primarily AHA! Nights. High visitation levels on Saturdays are due to weekend tourism, park programs, and city festivals such as Summerfest and Feast of the Blessed Sacrament. High visitation levels on Sunday are also due to city festivals as well as cruise ship arrivals.

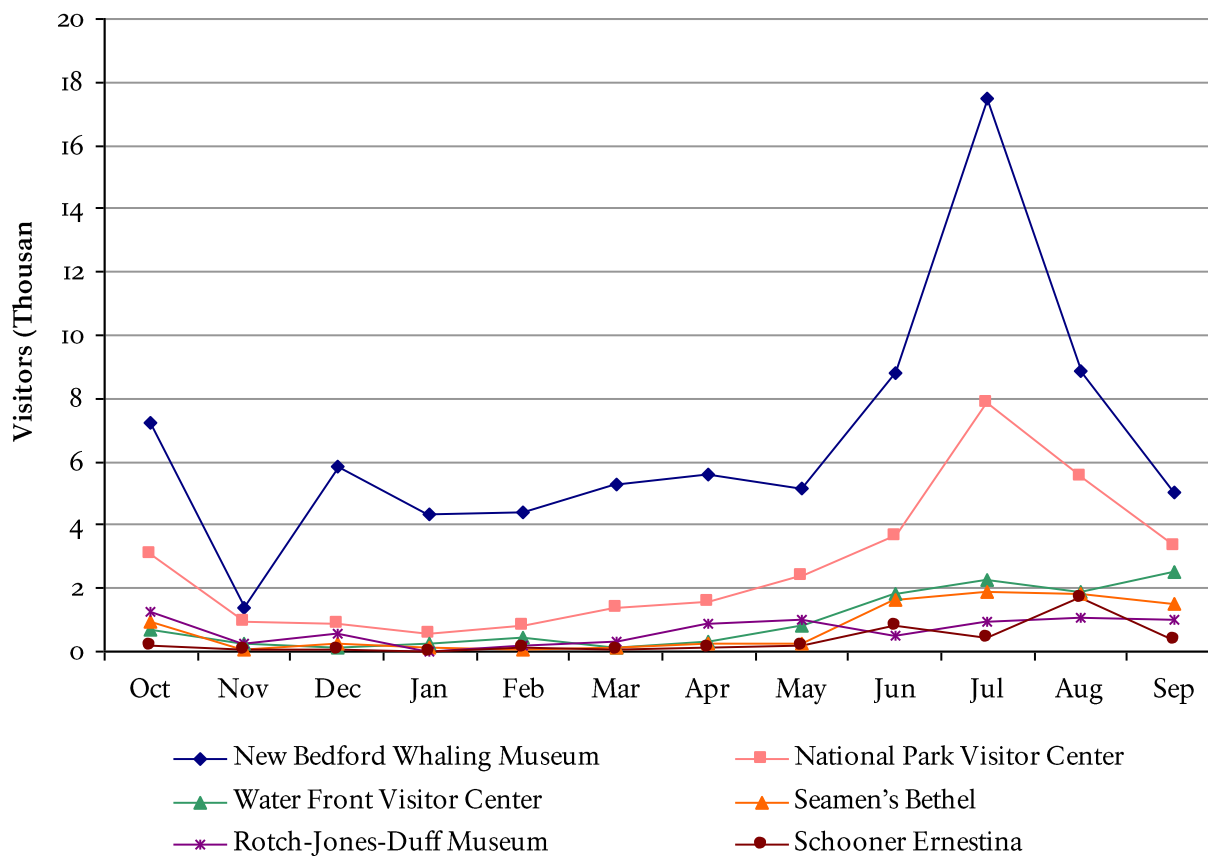
Figure 7
Average daily visits to the park. Samples taken July through September 2008
Source: The Volpe Center using NPS data



Monthly visitations to partner attractions are shown in Figure 8. The Whaling Museum is the most visited of the park's major attractions and is a popular destination for school fieldtrips. During the 2004-2005 school year, the museum's educational programs drew approximately 10,000 students from area schools, other parts of the country, and Cape Verde, mostly in the spring. The Visitor Center is the second-most visited site in the park. In FY 2008, 17,000 people alone viewed the Visitor Center's informational film. The Waterfront Visitor Center has the next largest visitation followed by the Seamen's Bethel, the Rotch-Jones-Duff House, and the Schooner Ernestina.

Figure 8
FY 2008 monthly visitations to park partner attractions.

Source: The Volpe Center using NPS data



Visitation characteristics of partner attractions are shown in Table 1. Visits to the Whaling Museum decreased significantly in 2008, echoing the regional trend of decreasing number of fieldtrips taken by schools due to transportation costs and focus on standardized tests^{iv}. Visits to the park Visitor Center increased significantly during the same time period.

Table 1

Visitation characteristics of park partner attractions and Visitor Center

Source: The Volpe Center using NPS data

Attraction	Visitation in FY 2008	Change between FY 2008 and 2007	Change between FY 2007 and 2006	Busiest Month(s)
Whaling Museum	79,348	- 25%	+ 5%	July
Park Visitor Center	32,217	+ 20%	- 1%	July
Waterfront Visitor Center	11,547	- 2%	+ 15%	July
Seamen's Bethel*	8,952	+ 4%	- 14%	July
Rotch-Jones-Duff House	8,057	+ 9%	- 16%	May and October

* Excludes religious functions and services

A park visitors study conducted in 1999 found the most common reasons for visiting were to visit the Whaling Museum (58%), to learn about whaling and maritime history (29%), and to visit the park in general (25%)^v. The most commonly visited sites were the Whaling Museum (79%), the park Visitor Center (52%), and the Seaman's Bethel (50%). The least visited site was the Rotch-Jones-Duff House (11%). The sites most often visited first were the park Visitor Center (41%) and the New Bedford Whaling Museum (36%).

Existing Conditions

This section of the report provides an overview of the existing transportation systems and facilities in the park and City of New Bedford.

Bus service

There are several bus service options in New Bedford, including The LOOP, trolley buses, ferry shuttles, the now defunct “Catch the Whale” shuttle, the Southeastern Regional Transit Authority (SRTA), which provides public transit bus service to Dartmouth, Fairhaven, Fall River, New Bedford, Somerset, and Swansea. These options are discussed and evaluated in more detail in the next section.

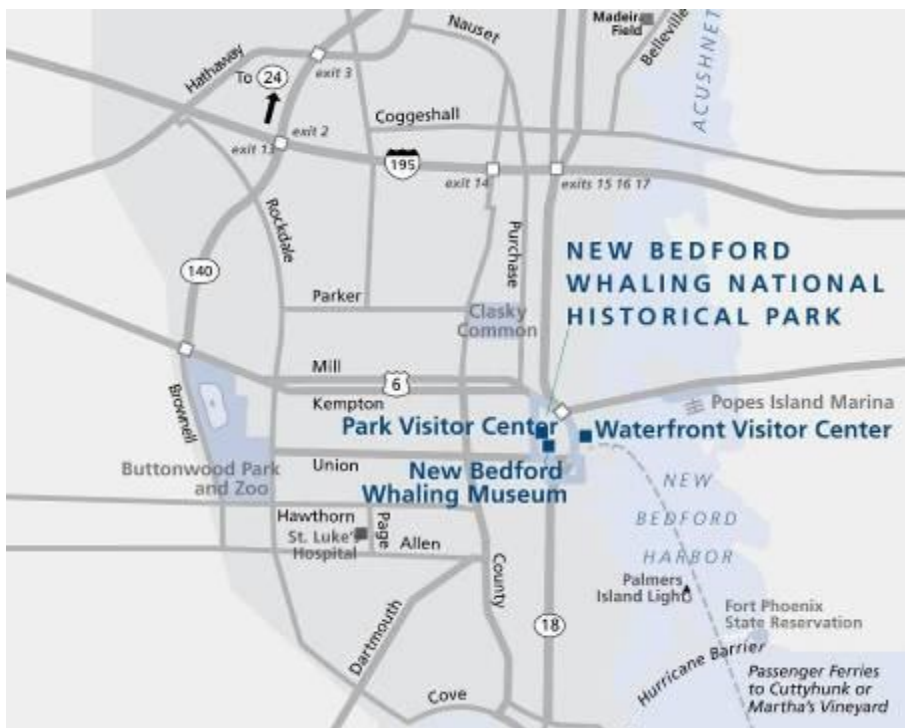
Traffic and circulation

Highways

New Bedford is served by several highways, as shown in Figure 9. Interstate 195 provides access to Providence (west) and to Interstate 495 and Cape Cod (east). U.S. Route 6 runs parallel with I-195 to the south and provides connectivity to Fall River and UMass Dartmouth (west) and Fairhaven and Cape Cod (east). State Route 140 begins at Route 6 and provides connectivity to State Route 24 (north), which provides access to Boston via Interstate 93. State Route 18 travels north-south. North of I-195, Route 18 is alternatively named Ashley Boulevard. South of I-195, Route 18 provides connectivity to US Route 6. There are signalized intersections south of Route 6 at Elm Street and Union Street that provide connectivity to the downtown street network.

Figure 9
New Bedford highways.

Source: NPS and the Volpe Center



In the summer and fall of 2009, \$16.3 million in federal and state funding will be used to begin to “boulevardize” Route 18 and demolish the pedestrian overpass that currently provides grade-separated pedestrian access between downtown and the wharf (see Figure 16). According to WHALE’s website:^{vi}

Called “the single biggest project other than the National Park to hit New Bedford in a generation”, the redesign of Route 18 will reconnect the Downtown Historic District and Whaling National Historical Park with the working waterfront. The plan will calm traffic, allow safer pedestrian passage, link neighborhoods, recapture lost economic opportunities and create a beautiful entrance into our National Park.

The final design has been separated into three phases, and the downtown section will be the first phase to be constructed. The downtown phase emphasizes public access to the waterfront from downtown and includes the creation of a new-shared use path linking the downtown with the southern section of the city and providing access to the Fairhaven Bridge. The plan also includes two new waterfront parks adjacent to the state pier. The city anticipates all design and bidding documents will be completed in early 2009. The city estimates that construction will start in August 2009 and end in 2010.

Downtown circulation

Downtown New Bedford can be defined as the area from Elm Street south to Walnut Street and from the waterfront west to County Street^{vii}. The downtown consists of a grid network of one- and two-way streets shown previously in Figure 3. The main east-west street is Union Street. Mill and Kempton Streets (US Route 6) also provide east-west access, as do Court and William Streets (east) and School and Arnold Streets (west). Route 18 / J.F. Kennedy Memorial Highway provides north-south access along the Acushnet River and the eastern edge of New Bedford, while Purchase and Pleasant Streets in downtown run north and 2nd and 6th Streets travel south. The streets are paved with cobblestones in the historical district of the city, bounded by Acushnet Avenue to the west, Elm Street to the north, Route 18 to the east, and Union Street to the south.

People drive private vehicles significantly more than they use other transportation modes in downtown New Bedford.

Parking

Lots and garages

The City of New Bedford owns and operates two structured parking garages, the Elm Street Garage and the Zeiterion Garage, and the Custom House Square surface parking lot (see Figure 1 for their location relative to the park). The City does not track utilization of the garage and lot but has revenue statistics for the last fiscal year:^{viii}

- Elm Street Garage = \$244,882.56
- Zeiterion Garage = \$ 90,617.64
- Custom House Square = \$ 26,181.50

The Elm Street Parking Garage is located at 51 Elm Street and contains 1,075 spaces, 200 of which are reserved for the Standard-Times Publishing Company through an arrangement with EDC. Roughly 70 of these 200 spots are used daily. Monthly rates are \$30 for non-students and \$15 for students. Hourly rates are \$10/day or \$1.50/hour for non-students and \$5/day or \$0.50/hour for students. Signage projects to improve recognition and clarity and exterior lighting projects to improve safety have been approved and are scheduled for implementation. The contract to repair the parking garage elevators was signed in early 2009.

The Zeiterion Performing Arts Center Parking Garage is located on Purchase Street between Spring and School Streets and contains 298 spaces, 50 of which are reserved for UMass Dartmouth. Monthly rates are \$42/month for non-students and \$21/month for students. Hourly rates are \$10/day or \$1.50/hour for non-students and \$5/day or \$0.50/hour for students.

The City also manages the Custom House Square Parking Lot. The Custom House lot contains 75 metered spaces. Rates are \$1/hour, payable in three hour increments, and payment can be repeated as often as desired. Payment is accepted via an automated parking payment machine that began operation in the late 1990s. The NPS has received complaints from visitors that the automated parking machine is often not working. Visitors having problems with the machine are directed to the City Traffic Commission in the Elm Street Parking Garage.

On-street parking

As of 2004, there were 1,025 on-street parking spaces in the downtown area^{ix}. Cars may park in on-street parking spaces for \$0.25 per half-hour for up to two hours. Payment for on-street parking is required between 9 AM and 6 PM. The highest occupancy rate for on-street parking is between 11 AM and noon.

Private parking

As of 2004, there were 2,476 private parking spaces downtown.^x Due to the existing capacity of public parking spots, the city is devising a plan to eliminate the minimum parking requirements for new development. New development is currently required to provide additional parking, but capacity already exists on the street, in the two garages, in surface lots, and in New Bedford's South End. To avoid the minimum parking requirements, developers have to go first to the Planning Board and then to the Zoning Board. Updated rules will make parking reduction or elimination a routine request that can be addressed in a single visit to the Planning Board. The new rules are awaiting city approval.

Whale's Tooth Parking Lot

Whale's Tooth Parking Lot, located at 532 Acushnet Avenue, is provided for ferry boat passengers and is operated by the HDC during peak ferry season, usually from April to October. In 2009, the ferry begins its early spring schedule on April 17 and ends its early fall service on October 12. The parking lot is located near Route 6, off Route 18 on Herman Melville Boulevard. The parking lot has 650 spaces and though the HDC does not track parking lot utilization, it suggests that the lot is underutilized most of the year. Rates for 2008 were \$10/day but are expected to rise to \$12/day in 2009. The parking lot is fenced, monitored by cameras, and features a 24-hour attendant. Whale's Tooth Parking Lot is a future potential station site for the South Coast Rail line.

State Pier parking lot

From October to April, parking is available directly on State Pier. Rates are \$10/day, \$120/month, and \$500/year^{xi}. Elm Street Garage permit holders may also park at State Pier in the winter and Whale's Tooth Parking Lot in the summer. The Pier's parking lot is manned with 24-hour security staff. In summer months, public parking at State Pier is prohibited since it is used for employee parking and passenger pick-up and drop-off for the ferry.

Pedestrian facilities

Downtown New Bedford is a compact and walkable area roughly 0.25 square miles in size. A historic district occupies approximately one half of this area. With the notable exceptions of Elm and Union Streets, most of the historic district is paved with smooth, rectangular Belgian Pavers. The sidewalks have smooth, round cobblestones laid in the side, and crosswalks are paved with flat, concrete slabs to ease street crossings.

Route 18, which separates the wharf and Acushnet River from downtown, is an impediment to pedestrian accessibility. Aside from signalized intersections at Elm and Union Streets, the highway is limited access and accommodates motorized vehicles traveling at high speeds. Figure 10 shows the city's planned improvements to "boulevardize" Route 18 and better connect downtown with the waterfront. Construction is expected to begin in 2009. Figure 11 is a view south from the pedestrian overpass showing the intersection of Route 18 and Union Street.

Figure 10
Planned improvements to Route 18 and associated intersections.

Source: New Bedford Economic Development Council



Figure 11
Intersection of Route 18 and Union Street. View south from pedestrian overpass.
Source: The Volpe Center



The overpass, the west side of which is shown in Figure 12, connects the historical district to the wharf over Route 18. The overpass, which provides both ramp and stair access, is scheduled for demolition following the improvements to Route 18.

Figure 12
West side of pedestrian overpass.
Source: The Volpe Center



Self-guided and guided walking tours

In July and August, free NPS volunteer and ranger-led walking tours last approximately one hour and start from the park Visitor Center at 10:30 AM, 12:30 PM, and 2:30 PM, seven days a week. These tours visit attractions within the park. A self-guided tour published by the NPS, “Behind the Mansions”, is shown in Figure 13. The tour begins at Wing Street, five blocks south of the Rotch-Jones-Duff House and Garden Museum. The New Bedford Preservation Society does offer other guided and self-guided walking tours.

Figure 13
"Behind the Mansions" self-guided walking tour map.

Source: NPS

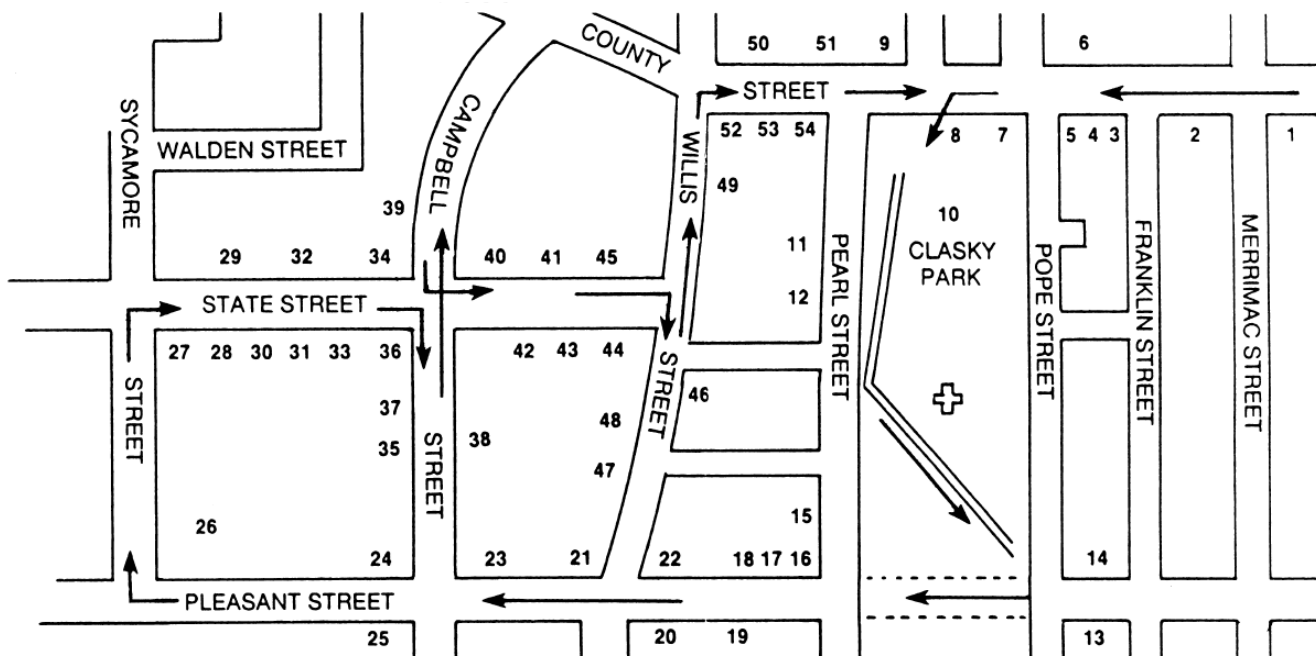


The New Bedford Preservation Society has designed four walking tours of areas near downtown, including Acushnet Heights, County Street, Kempton's Corner, and West of County. Brochures containing parking, walking, and historic information for each of the tours are posted on the organization's website and are available at the park Visitor Center. A map of the Acushnet Heights walking tour is shown in Figure 14.

Figure 14

Acushnet Heights walking tour map (numbers correspond to points of interest).

Source: New Bedford Preservation Society



Bicycle facilities

Bicycling is not currently a popular mode of transportation in downtown New Bedford. There is presently very little bicycle infrastructure in the city, though bike lanes will be included in the Route 18 improvements. There are a few bicycle racks downtown, but the presence of cobblestone streets presents a significant deterrent for potential cyclists.

In its 2008-2013 Open Space and Recreation Plan, the city documents citizen requests for bike trails along the Acushnet River connecting New Bedford, Dartmouth, and Fairhaven^{xii}. The plan articulates an objective to construct a city-wide multi-use trail system. To meet this objective, the city would like to develop a bicycling master plan.

The National Recreation and Parks Association recommends one mile of bike trails for every 2,000 people. In 2007, the Census Bureau estimated New Bedford's population to be 91,849. To meet these standards New Bedford would have to provide roughly 45 miles of bicycle trails. The city currently provides 4.5 miles of bicycle trails.

Streetscape improvements

The City of New Bedford has been actively identifying and completing small scale street projects that are within the context of what is already planned in and around the downtown^{xiii}. The following streetscape improvements were made in 2007:

- 286 trees pruned and maintained;
- 47 repairs to sidewalks and crosswalks;
- 338 graffiti sites removed throughout the city, with 60 sites removed in the downtown;
- 200 feet of fencing on Front Street repaired and painted; and
- Repairs and upgrades to Custom House Square including the installation of replacement columns, new center roof, cobblestone of perimeter planting bed, and the construction of a new entrance structure and signage.

In 2008, the park and the city of New Bedford collaborated to upgrade existing streetlamps, installing new streetlamps that were more consistent with the historic character of the park district. Improved signage for the Elm Street Garage was installed in 2009. Trailblazer signage to guide tourists in and around the park has also been approved and will be installed in 2010.

HDC, EDC, and the city of New Bedford Office of Tourism and Marketing are making cosmetic improvements on State Pier to welcome American Cruise Lines passengers and create a pedestrian-friendly identity for downtown New Bedford as passengers disembark. These improvements include:

- A pathway leading to attractions – a pathway will be painted as soon as weather allows, likely in April 2009;
- Large “Welcome to New Bedford” arch sign – this project will be completed by students at the Greater New Bedford Regional Vocational Technical High School. The sign is expected to be completed by summer 2009, depending on project scheduling at the school.
- Landscaping/potted plants – two large pots near a recycling center will be planted in April 2009. Other potted plants are planned, depending on availability of funds.
- Facade improvement of the main building – the main building will be painted in spring 2009.
- Nearby park benches/seating – two benches have been installed near the cruise ship slip.
- Improved lighting – lights will be installed to illuminate the new sign; ways to illuminate the area in general are being investigated.

Signage

The park is working with its partners and downtown stakeholders in the development of a trailblazer signage system in and around downtown to help visitors find major attractions. Planning for this \$55,000 NPS-funded project is complete and the fabrication and installation of the signs is scheduled for mid 2010. An example of the trailblazer signage is shown in Figure 15 and a map of trailblazer locations is shown in Figure 16.

New signage for the Elm Street Parking Garage has been approved by the Historical Commission to help visitors use the garage and know how to directly exit the garage on foot. The new parking signage is consistent with public design standards to improve visitor recognition and clarity.

Figure 15
New Bedford Whaling National Historical Park pathfinder and pedestrian guides.

Source: NPS^{xiv}

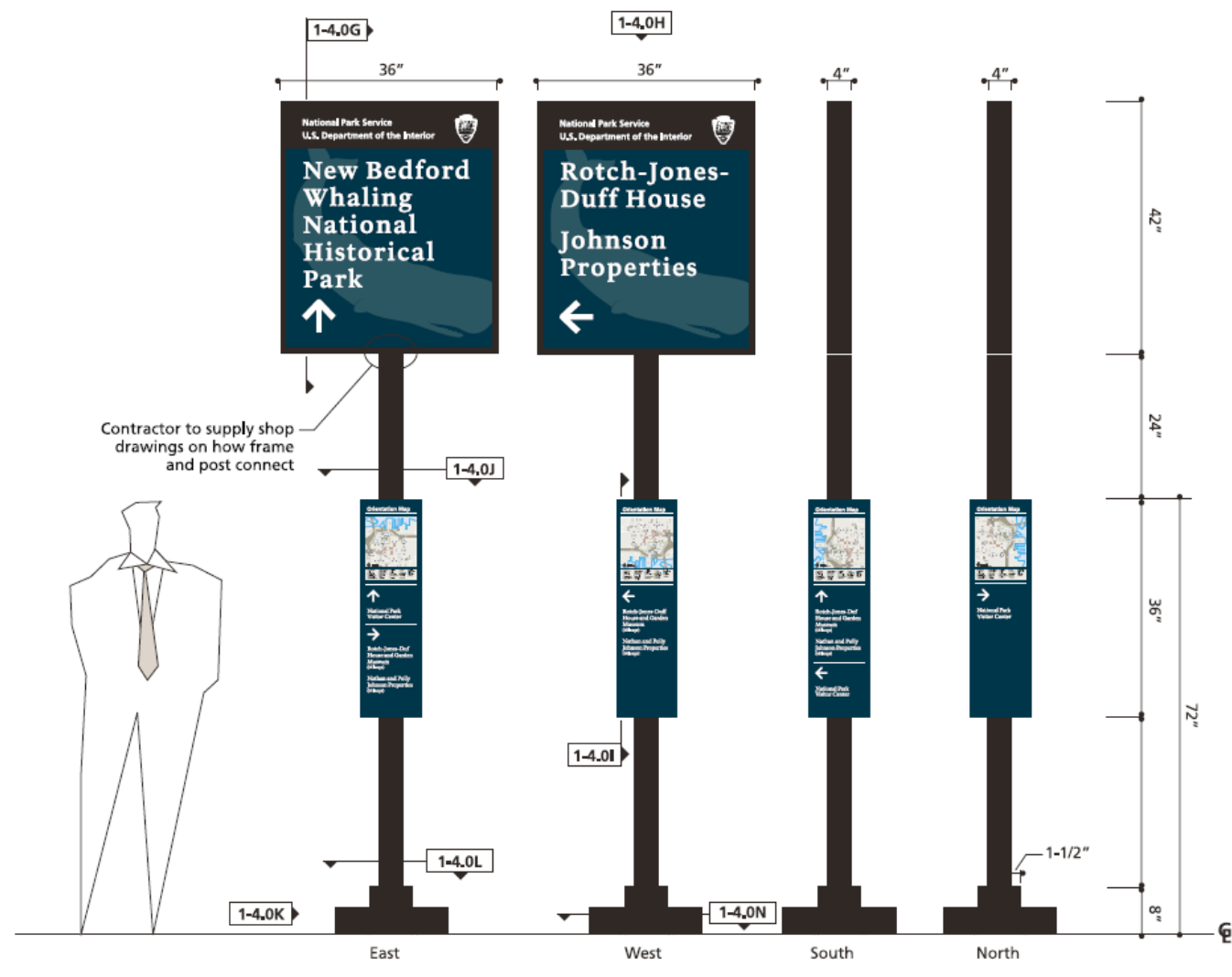


Figure 16
Map of New Bedford Whaling National Historical Park proposed trailblazer signage.
 Source: NPS



Ferry Services and Cruise Ships

New England Fast Ferry

The New England Fast Ferry transports passengers from New Bedford to Vineyard Haven on Martha's Vineyard. The New Bedford Ferry Terminal is located on the north side of State Pier. Each ferry can transport up to 150 persons and takes an hour to travel between New Bedford and Martha's Vineyard. Between 82,000 and 116,000 embarkations are made annually, as shown in Figure 17.

Figure 17
Annual embarkations (two ferries for all years except 2004).

Source: New England Fast Ferry Data and the Volpe Center

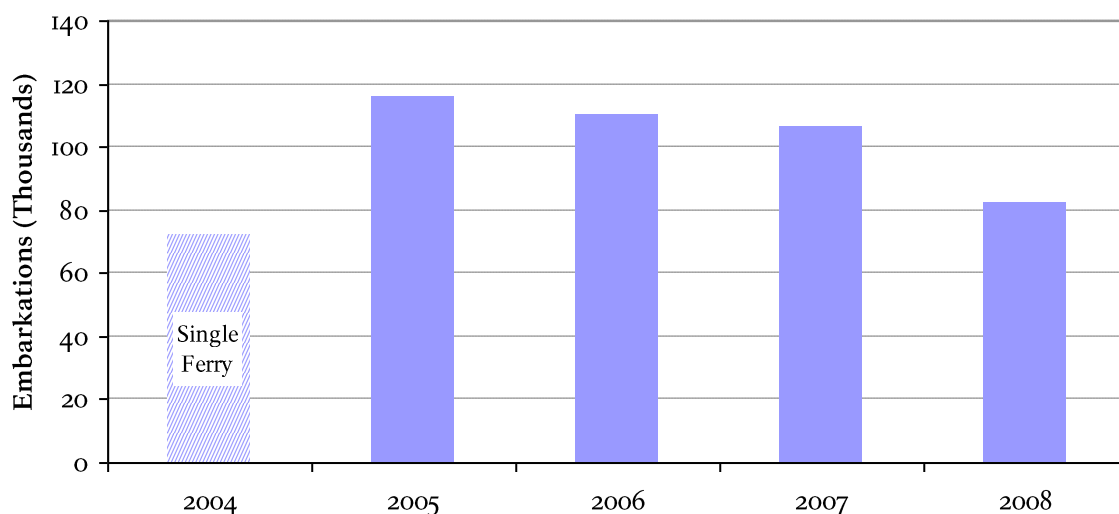
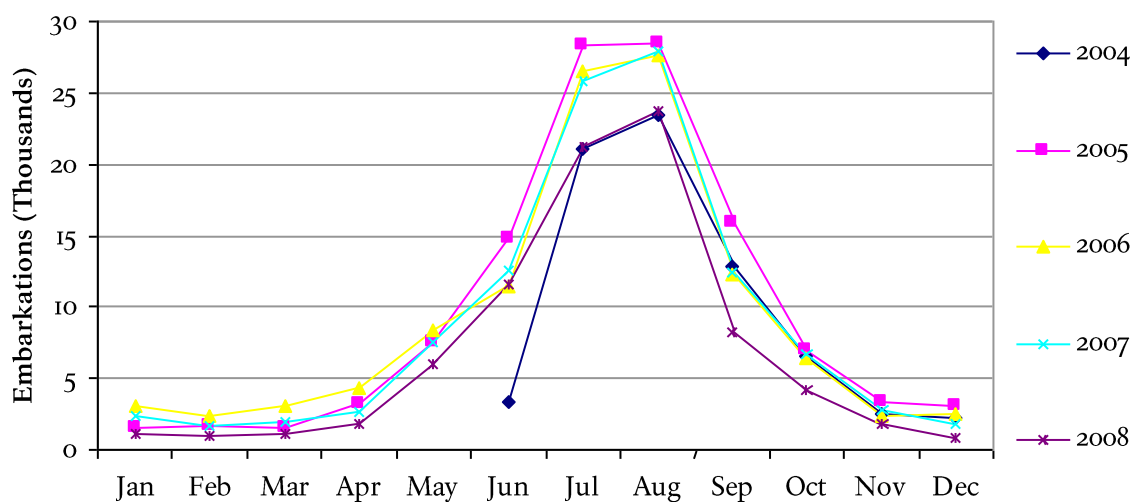


Figure 18 depicts the seasonal popularity of the ferry service, which transports the most people during the warm, summer months.

Figure 18
Monthly fast ferry embarkations by year (two ferries for all years except 2004).

Source: New England Fast Ferry Data and the Volpe Center



To account for varying seasonal demand, in past years the ferry operated peak-season (summer) and off-season (winter) schedules, each offering uniform service each day of the week. Beginning in 2009, the ferry operated six schedules, shown in Table 2, each with more round trips late in the week and fewer round trips early in the week. Starting in 2009, the ferry will not operate from December 1, 2009, to March 31, 2010. Historically, the ferry serves residents, visitors, and construction contractors between the months of December and May.

Table 2
Scheduled 2009 Fast Ferry round trips between New Bedford and Martha's Vineyard.

Source: New England Fast Ferry Company

Dates	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.
Dec. 1, 2008 – April 17, 2009	2	2	2	2	2	0	0
April 18 – May 18, 2009	2	2	2	2	2	2	2
May 19 – June 23, 2009	5	5	5	5	6	4	4
June 24 – Sept. 9, 2009	5	5	5	7	8	7	7
Sept. 10 – Oct. 12, 2009	5	5	5	5	6	4	4
Oct. 13 – Nov. 30, 2009	2	2	2	2	2	2	2

Adult tickets cost \$35 one way and \$70 roundtrip. Tickets for children ages 3 to 12 are \$20 and \$40, respectively. Children under three travel free with their parent(s). Tickets for seniors over 65 are \$31 and \$62, respectively. Passage for bicycles is \$6 and \$12, respectively. Tickets may be purchased in 10-trip bundles for \$285. The ferry does not transport automobiles but can accommodate small freight.

Cuttyhunk Ferry

Cuttyhunk Ferry Company, Inc., provides passenger and freight ferry service from State Pier in New Bedford to Cuttyhunk Island, the outermost island of the Elizabeth Islands off the South Coast of Massachusetts. The island's population of 52 swells in the summer as vacationers come to enjoy the island's beaches and sportfishing. Since 2006, the ferry has accommodated roughly 15,000 embarkations a year, up to 149 passengers per trip. Travel time to Cuttyhunk Island is about an hour. The Cuttyhunk Ferry offers more round trips on weekends and in spring and warmer months than it does on weekdays and colder months, as shown in Table 3. Adult fares are \$25 each way and \$40 for same-day round trip journeys. Child fares are \$20 each way and \$30 for same-day round trip journeys.

Table 3
Scheduled 2009 Cuttyhunk Ferry round trips between New Bedford and Cuttyhunk Island.

Source: Cuttyhunk Ferry Company

Dates	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.
Oct. 20, 2008 – April 13, 2009	1	0	0	0	1	0	0
April 14 – May 21, 2009	1	0	0	0	1	1	1
May 22 – June 19, 2009	1	1	1	1	2	1	1
June 20 – Sept. 7, 2009	1	1	1	1	2	2	2
Sept. 8 – Sept. 27, 2009	1	1	1	1	2	1	1
Sept. 28 – Oct. 18, 2009	1	0	0	0	2	1	1

American Cruise Lines

American Cruise Lines offers small ship, multi-day cruising along inland waterways, bays, and rivers of the east coast of the United States. New Bedford is a port of call on American Cruise Lines' "New England

Islands” cruise, shown in Figure 19. There were approximately 20 arrivals in 2008 with 100 passengers each, for a total of 2,000 cruise ship visitors. Upon arrival in New Bedford, cruise ship visitors are transported by three trolley-style buses to various points of interest including the Rotch-Jones-Duff House and Garden Museum and the New Bedford Whaling Museum.

Figure 19
American Cruise Lines' "New England Islands" cruise map.
Source: American Cruise Lines' website



Train Station and Rail Services

Though passenger rail does not currently serve New Bedford, the Massachusetts Executive Office of Transportation (EOT) is evaluating several rail alternatives to connect Fall River and New Bedford to Boston. Since April 2007, when Governor Patrick released *South Coast Rail: A Plan for Action*,^{xv} the EOT has been working with stakeholders and communities to propose and investigate alternative alignments.

Four alternative routes between Boston and Fall River and New Bedford have been proposed and analyzed for environmental, technical, and economic feasibility. Completed tasks include ridership and capacity modeling, environmental fieldwork, and submittal of the Federal Notice of Intent and State Environmental Notification Form. Future tasks over the next year include identifying specific station sites, issuing the project scope, preparing draft and finalized Environmental Impact Report/Statements, and preparing draft and finalized Smart Growth Corridor Plans.

In addition to a no-build option, the three alternative alignments to be studied further in the draft Environmental Impact Report/Statements are through Middleborough, through Stoughton, and bus rapid transit (BRT) using an improved highway system. The completed ridership study estimates increases in commuter rail trips in the entire corridor as: via Middleborough – 3,400 trips, via Stoughton – 11,200 trips, and via BRT – 6,000 trips^{xvi}.

Two station sighting workshops took place in New Bedford on November 13 and 19, 2008. The purpose of these workshops was to engage stakeholders and the community in a discussion about key community

Air provides more than a dozen daily scheduled flights to the islands and a half dozen during the winter months. Scheduled airtime from New Bedford to the islands is 20 minutes. In 2008, roughly 24,000 passengers flew Cape Air via the New Bedford Regional Airport terminal. Although the airport is served by SRTA Route 8/Mt. Pleasant, the majority of travelers using New Bedford Regional airport arrive or depart by private automobile.

Description and Evaluation of Current New Bedford Shuttle Services

This section of the report describes and evaluates past and current shuttle and transit services operating in New Bedford. These services include the ferry shuttle, The LOOP shuttle, the ad-hoc trolley buses, Southeast Regional Transit Authority (SRTA) buses, and the defunct “Catch the Whale” service. This section evaluates these services to identify potential partnerships and to obtain lessons learned regarding local and visitor usage patterns, operations and maintenance costs, and operations and logistics.

Ferry Shuttle

The ferry shuttle service began in 2004 and is operated by City of New Bedford Harbor Development Commission (HDC) and consists of three buses operating on two routes. It primarily serves the 70,000 to 100,000 people each year who take the New Bedford Fast Ferry from New Bedford to Martha’s Vineyard. The first route runs from April 1 to October 31 and consists of two 1999 Bluebird buses (Figure 21) that transport passengers 0.5 miles between State Pier and WTPL. The Bluebird buses are under consideration for replacement.

Figure 21
HDC Bluebird ferry parking shuttles.

Source: The Volpe Center



The second route runs late May through August and consists of a 24-seat 2008 Chevrolet El Dorado Aero Elite shuttle bus that travels a 1.5 mile path through downtown and stops at the Elm Street garage. The latter route is on-demand only, and the Chevrolet shuttle bus is used for the UMass Dartmouth’s The LOOP service during the school year. Figure 22 illustrates the ferry shuttle routes for the port of New Bedford.

Figure 22
Ferry shuttle routes.
 Source: HDC



Service begins an hour before each ferry departure and ends one hour after each ferry arrival in the peak season, April 1 to October 31. The routes are scheduled so that no passenger has more than a 20 minute wait time on either end of the route. In the winter months, passengers park on State Pier as ferry travel to

Martha's Vineyard slows and the number of available spaces on State Pier is sufficient to meet the demand for parking.

Ridership levels of the two routes are unknown since HDC does not collect this information. However, the fast ferry operator estimates that a large portion of its customers utilize the ferry shuttle in the summer months. During April through October 2008, there were 76,000 ferry passengers. Assuming 80 percent of ferry passengers use the ferry shuttle (and the remaining 20 percent are dropped off or picked up by other means), the shuttle may serve as many as 60,000 passengers during these months. Depending on the actual number of passengers served and the breakdown of trips among the two routes, there may be opportunities for the park to partner with the HDC on a shuttle service that also serves the park. The busiest time for shuttle service are summer weekends with peaks during Memorial Day, July 4th, as well as Labor Day.

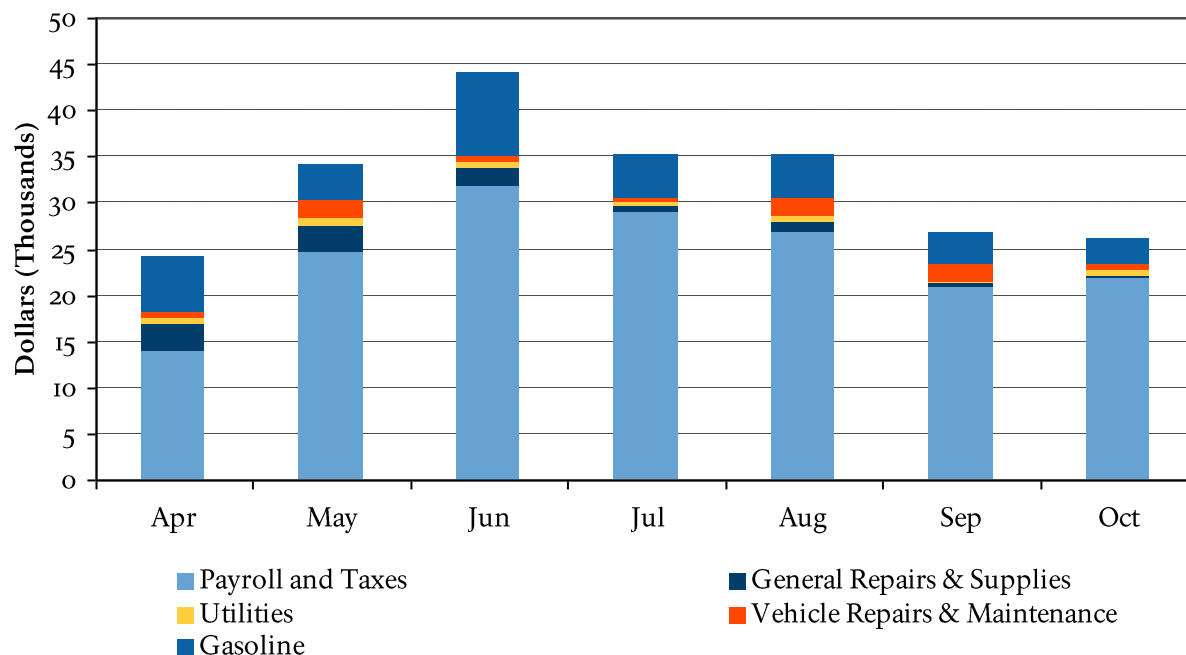
Also based on discussions with the ferry operator, the majority of ferry shuttle riders are thought to ride the first shuttle route that travels exclusively between State Pier and WTPL. Changing this route by adding additional stops downtown would increase the travel time and may ultimately cause some ferry customers to use competing ferries to Martha's Vineyard from other cities since ferry passengers have remarked that they enjoy the ease of use and transfer using the shuttle between the WTPL and State Pier. Accordingly, altering or replacing the first route is likely an infeasible option.

Customers must specifically request to take the downtown service. Since this service is demand only and very few people actually request it, it is assumed that the downtown route is less popular than that of the WTPL service. There may be an opportunity to alter or exchange this service with one that serves a wider base of people and connects the park and its partner destinations. Obtaining rider counts on the ferry shuttle from the HDC would help illuminate the feasibility of this opportunity.

The ferry shuttle operations and maintenance costs may be used to estimate the costs of a shuttle serving the park. Operating and maintenance costs for the ferry shuttle are shown in Figure 23 and Table 4 for April through October 2008. Total costs for this period for three vehicles are roughly \$226,000. Costs for a comparable single vehicle would thus be \$76,000, or an average of roughly \$11,000 a month per vehicle.

Figure 23 and Table 4
Ferry shuttle service expenses, April 1, 2008 – October 31, 2008.

Source: The Volpe Center using HDC data



	Apr.	May	June	July	Aug.	Sep.	Oct.	Total
Gasoline	\$6,146	\$3,902	\$9,210	\$4,777	\$4,777	\$3,437	\$2,722	\$34,969
Vehicle Repairs and Maintenance	668	1,951	560	538	1,974	1,906	627	8,224
Utilities	721	809	805	439	501	338	622	4,236
General Repairs and Supplies	3,021	2,824	1,960	480	1,049	363	222	9,919
Payroll and Taxes	13,764	24,710	31,724	29,090	26,924	20,807	21,931	168,949
Total	24,319	34,196	44,258	35,324	35,225	26,851	26,124	226,296

If the shuttle serves 60,000 passengers during April through October (as estimated above), it must make at least 2,500 vehicle trips because the maximum passenger occupancy of the vehicles is 24 persons. Because each trip is likely not filled to capacity, the total number of vehicle trips is likely greater, perhaps as many as 3,000. Thus cost per vehicle trip to operate and maintain the service is estimated at \$75, the cost per passenger trip is estimated at \$3.75, and the cost per day is estimated at \$1,614.

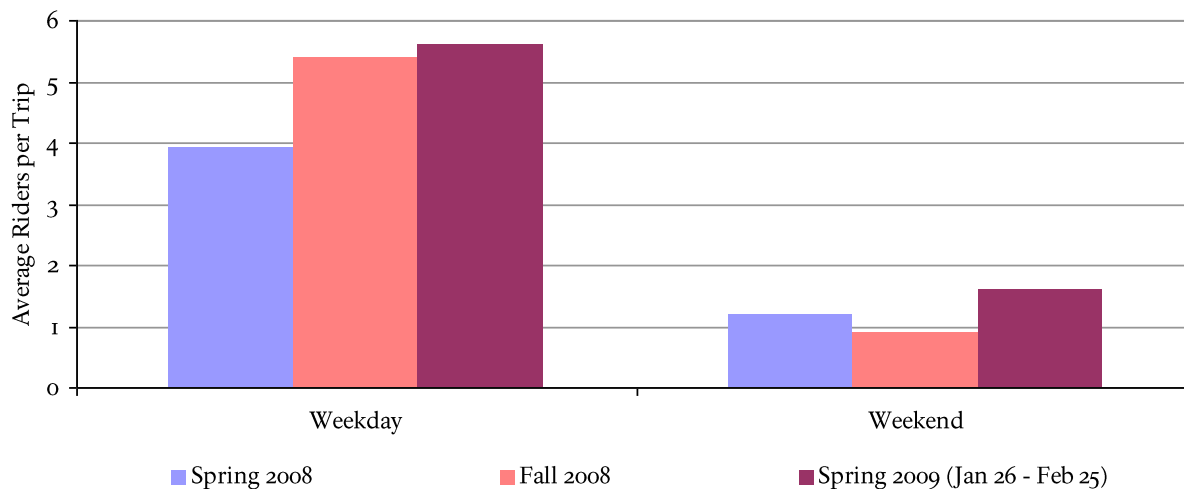
The LOOP

The LOOP shuttle is an express service connecting UMass Dartmouth's Main Campus and its College of Visual and Performing Arts (Star Store) in downtown New Bedford. The 8.5 mile trip takes roughly 20 minutes and includes no stops between the two endpoints. The service is funded jointly by City of New Bedford and UMass Dartmouth and is operated by the HDC. UMass Dartmouth provided \$16,000 for the spring 2008 semester and is providing \$45,000 for the fall 2008 and spring 2009 semesters combined, which averages to \$5,000 for each month of service^{xix}. Initially offered during the 2008 spring semester (January 28th through May 23rd), The LOOP was expanded in the fall semester (September 2nd through December 17th) of that year to include more than twice as many trips per day. These extra trips were added as a response to a student survey, which also found that almost half of those using The LOOP for classes were also using it for downtown shopping.^{xx} Average ridership per trip, shown in Figure 24, has generally increased each semester (with the exception of weekend ridership in fall 2008) since the inception of the service.

Figure 24

Average number of passengers per trip by semester on The LOOP.

Source: The Volpe Center using NPS data



The current schedule was devised to coincide with class schedules so that riders can make it to class and ride The LOOP back to campus from downtown when classes are over. The trip lasts roughly 20 minutes in one direction. The LOOP does not run on student holidays or during winter, spring, or summer breaks. The schedule is as follows^{xxi}:

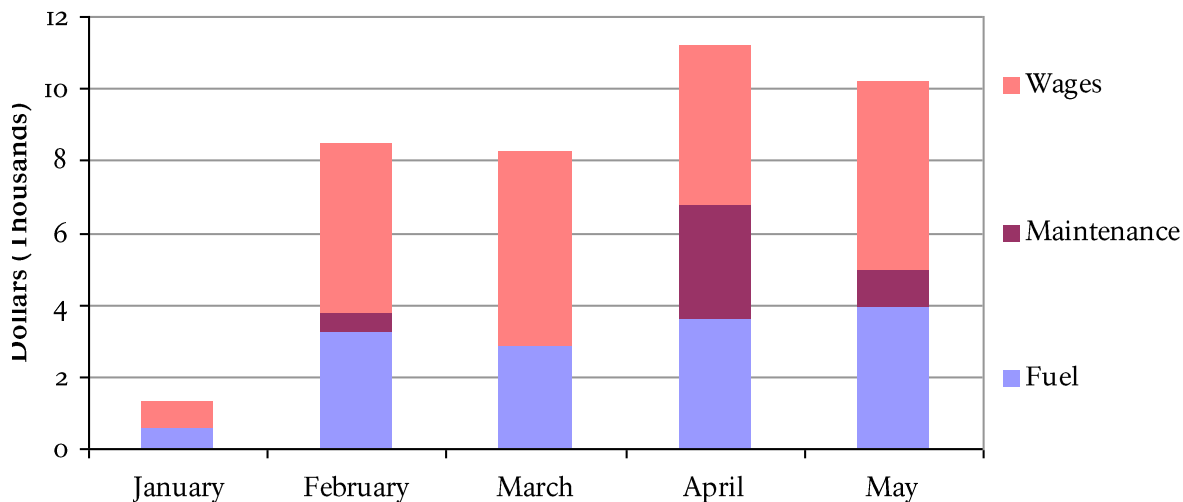
- All days – all buses departing downtown leave at 35 minutes past the hour (except for the first morning bus which leaves at 25 minutes past). All buses departing campus leave on the hour. There are no 3:35 PM, 4:00 PM, 4:35 PM, or 5:00 PM buses.
- Monday-Thursday – there are 10 trips in each direction throughout the day from 7:25 AM to 7:00 PM, with the exception of afternoon buses described above.
- Friday – there are 9 trips in each direction from 10:35 AM to 9:00 PM, with the exception of afternoon buses described above.
- Saturday – there are 4 trips in each direction from 6:35 PM to 10:00 PM.
- Sunday – there are 4 trips in each direction from 1:35 PM to 8:00 PM, with the exception of afternoon buses described above.
- AHA! Thursdays (second Thursday of each month) – there are two additional buses in each direction, from 7:35 PM to 9:00 PM.

Total passenger trips for the 2008 spring semester were 10,447 and total operating costs were \$39,195.81. The breakdown of costs for this period is shown in Table 5 and Figure 25.

Table 5 and Figure 25**Operation and maintenance costs for The LOOP, Spring 2008.**

Source: Volpe Center using HDC data

	January	February	March	April	May	Total
Wages	\$746	\$4,736	\$5,365	\$4,436	\$5,232	\$20,515
Maintenance	0	498	3	3,219	1,048	4,768
Fuel	559	3,237	2,865	3,561	3,902	14,125
Total	1,305	8,471	8,234	11,217	10,181	39,408



Due to the benefits to students derived from the express nature of The LOOP, UMass may be reluctant to alter or add stops along the route unless these stops provide significant value to its existing riders. Although opportunities to partner may be limited during months in which the services overlap, cost ridership figures for The LOOP may inform estimates for a new shuttle serving the park.

Operations and maintenance (O&M) costs are shown in Table 6 and Figure 26. Maintenance and fuel costs were particularly high during the spring 2008 semester and tailed off dramatically during fall 2008 and spring 2009, consistent with declining fuel costs.

Table 6**Operations and maintenance costs for The LOOP. April data does not contain fuel costs. May data is not reported.**

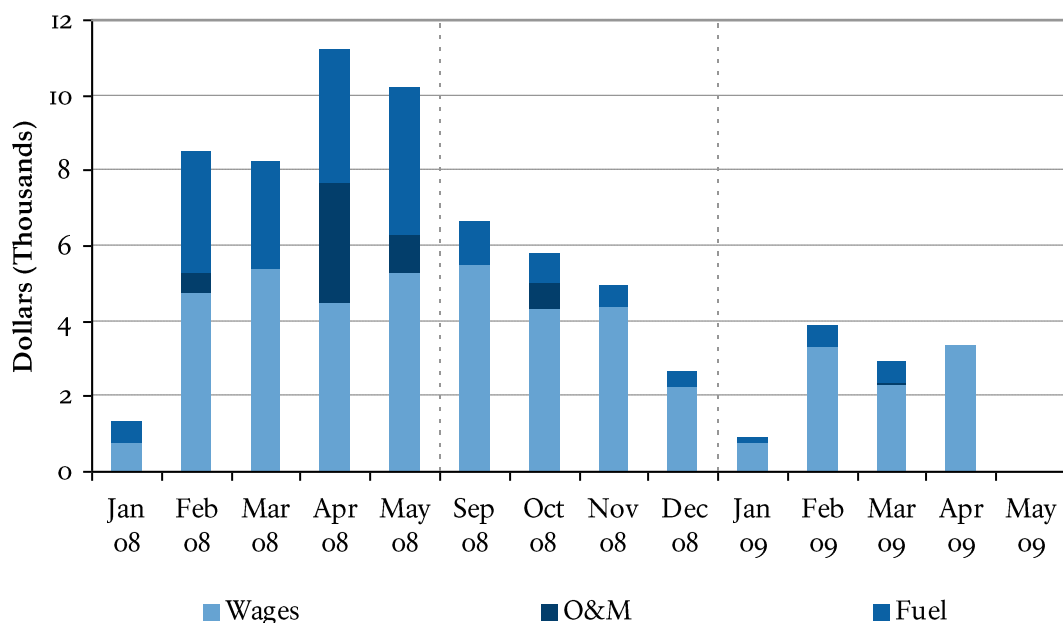
Source: The Volpe Center using NPS data

	Jan. o8	Feb. o8	Mar. o8	Apr. o8	May o8	Sept. o8	Oct. o8	Nov. o8	Dec. o8	Jan. o9	Feb. o9	Mar. o9	Apr. o9*
Fuel	559	3,237	2,865	3,561	3,902	1,155	836	580	434	188	596	560	
O&M	0	498	3	3,219	1,048	37	650	0	0	0	0	39	0
Wages	746	4,736	5,365	4,436	5,232	5,455	4,316	4,378	2,220	717	3,281	2,304	3,356
Total	1,305	8,471	8,234	11,217	10,181	6,648	5,802	4,958	2,654	905	3,877	2,903	3,356

* Partial month data

Figure 26
Operations and maintenance costs for The LOOP.

Source: The Volpe Center



Estimated ridership for The LOOP is shown in Table 7. Note that service was decreased from roughly 3,200 runs in Spring 2008 to 1,700 runs during Fall 2008 and that data collection for Spring 2009 is reported through April 26th. Following the cuts in service from Spring 2008 to Fall 2008, total passengers declined roughly 20 percent while the average passengers per vehicle trip increased over 40 percent. During Fall 2008 and Spring 2009 ridership has remained steady around 77 passengers per day and 4.6 passengers per trip. Table 7 also reports operations and maintenance costs by semester which have declined sharply due to the cutback in service, fewer maintenance activities, and declining fuel costs. Costs per day, per vehicle trip, and per passenger have also declined dramatically.

Table 7
Estimated operating days, runs, rides, and operations and maintenance costs (O&M) for The LOOP shuttle service. Counts for Spring 2009 are from January 26 to April 26. O&M costs for Spring 2009 include neither fuel costs for April nor any costs for May.

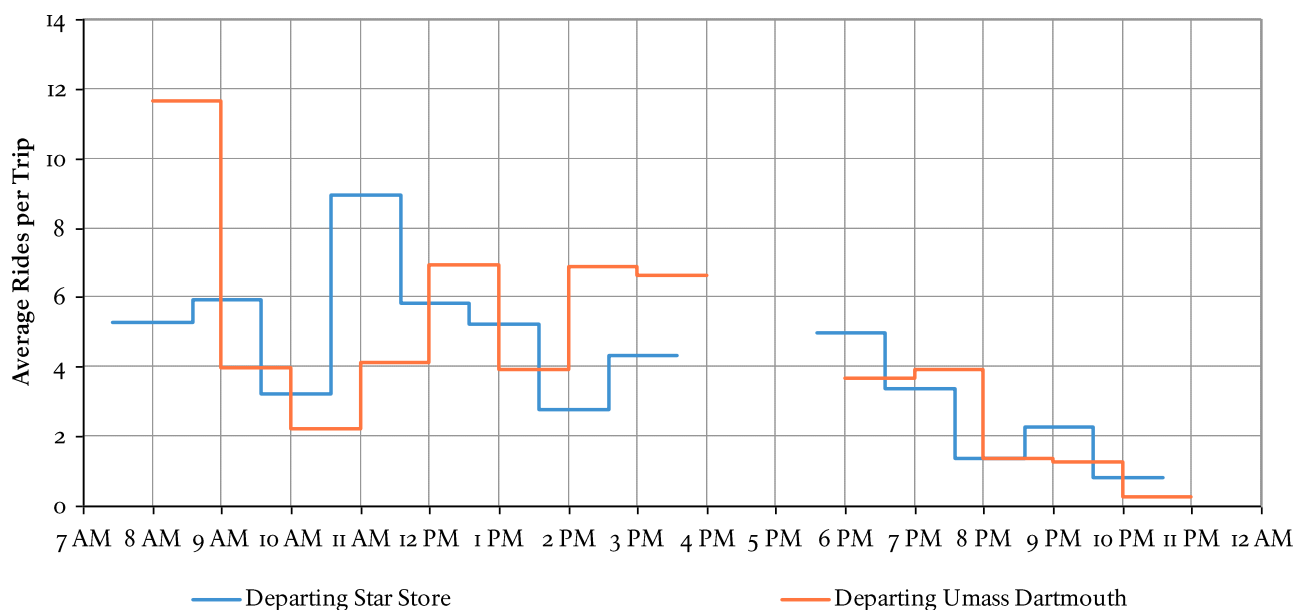
Source: The Volpe Center using NPS data

	Spring 2008	Fall 2008	Spring 2009*
Days	112	104	81
Vehicle Trips (runs)	3,173	1,708	1,336
Passengers (rides)	10,447	8,049	6,193
Average Passengers / Day	93.3	77.4	76.5
Average Passengers / Trip	3.3	4.7	4.6
Total O&M Costs	\$ 39,408	\$ 20,061	\$ 11,041
O&M Cost / Day	\$ 351.86	\$ 192.89	\$ 136.31
O&M Cost / Vehicle Trip	\$ 12.42	\$ 11.75	\$ 8.26
O&M Cost / Passenger	\$ 3.77	\$ 2.49	\$ 1.78

Average passengers per trip by time of day for the fall 2008 and spring 2009 semesters (those semesters following the schedule change) are shown in Figure 27. Trips from downtown to the main campus peak for the 10:35 AM bus. Trips from the main campus to downtown peak in the morning at 8:00 AM and at noon and in the mid-afternoon at 2:00 and 3:00 PM. Ridership in both directions generally decreases during evening hours.

Figure 27
Average passengers by vehicle trip on The LOOP.

Source: The Volpe Center



Trolley Buses

Three trolley-style buses are owned and operated by City of New Bedford for special occasions, tourism, and transportation of national and foreign dignitaries. The trolleys regularly transport American Cruise Line ship passengers to the Rotch-Jones-Duff House, the Whaling Museum, and back to the cruise ship. The diesel trolleys were donated to the city by SRTA several years ago. The trolleys are not handicapped-accessible and carry 28 seated passengers each. The trolleys do not have fixed or scheduled service and are only used on an as-needed basis. In 2008, there were 20 American Cruise Line arrivals with 100 passengers each, for a total of 2,000 cruise ship visitors who may have ridden a trolley. There may be opportunities to expand the trolley buses service to a regular service that serves the downtown.

Maintenance costs for the three trolley-style buses from December 2008 through May 2009 were \$500, \$1,092, and \$646, respectively. Fuel costs are not available and the service does not track riders.

Southeastern Regional Transit Authority

The Southeastern Regional Transit Authority (SRTA) provides public transit bus service to Dartmouth, Fairhaven, Fall River, New Bedford, Somerset, and Swansea. In 2007, SRTA provided service for 1.67 million unlinked trips and 4.86 million passenger miles of travel.^{xxii} SRTA routes run on a “pulse” model, meaning that all routes emanate from a central hub and return to that hub. There are hubs in Fairhaven and New Bedford. Eleven routes serve the New Bedford hub and 13 currently serve the Fall River hub. These routes primarily use 6th Street and Pleasant Street to leave the station and the downtown area. Currently no SRTA route solely circulates through downtown New Bedford.

Rates for the public are based on a zone system and are \$0.60 per zone for children and seniors and \$1.25 per zone for adults. A monthly pass for unlimited use of all fixed route service within the SRTA system is available for \$55. UMass Dartmouth and SRTA are currently testing a pilot program that allows Dartmouth students, faculty, and staff to access SRTA buses for free. UMass provided \$5,000 a month to SRTA for this pilot program, which started in December 2008 and concluded on May 31, 2009. SRTA reported that the program served roughly 3,800 trips per month (passengers served).

There may be an opportunity for the park to partner with the City of New Bedford and SRTA to create a downtown shuttle service. If the park is able to provide capital funding, the city has expressed some interest in financing operations and maintenance, and SRTA may be able to operate a downtown shuttle service. SRTA has operated such a downtown loop service, Catch the Whale, in the past.

The National Transit Database reports that in 2007 SRTA spent \$11.9 million in operations and maintenance costs and provided 1.7 million passenger trips over 313 days (SRTA does not operate on Sundays). In 2007, SRTA operated roughly 267,000 vehicle trips. Thus, the average operations and maintenance costs are \$7 per passenger trip, \$44 per vehicle trip, and \$38,000 per day.

Catch the Whale

The Catch the Whale shuttle was operated by SRTA from 1998 to 2002. This free service made a continuous 15-minute loop around downtown New Bedford beginning at 7:40 AM and ending at 6:20 PM. The shuttle stopped at locations including the Elm Street Parking Garage and City Hall. On AHA! Nights, Catch the Whale stopped at all AHA! sites. The service averaged 120 passengers per day during weekdays with a maximum count of 165 passengers. The shuttle service was advertised to park visitors, but a 1999 survey estimated that it was used by only roughly one percent of visitors. Annually, the park receives about 300,000 visitors. The importance or quality of service could not be determined from the survey because the number of visitor groups surveyed was statistically insignificant.

Several lessons learned from Catch the Whale inform transportation alternatives in downtown New Bedford. SRTA and city officials indicated that several issues contributed to declining ridership and the ultimate cancellation of Catch the Whale. A successful downtown shuttle service would have to overcome these challenges:

- The vehicle's windows were partially covered with decals and window tinting and gave the impression of a dark interior;
- The growth in homeless riders detracted from the overall rider experience; and
- Free service caused Catch the Whale to suffer financially.

Conclusions

This evaluation of past and current transit services provides comparable operations and maintenance costs and guidance on vehicle design and operations policies to attract and retain riders. Comparable operations and maintenance costs are as follows:

- Ferry Shuttle: \$3.75 per passenger trip, \$75 per vehicle trip, \$1,614 per day
- The LOOP (Fall 2008): \$2.49 per passenger trip, \$11.75 per vehicle trip, \$193 per day
- SRTA: \$7 per passenger trip, \$44 per vehicle trip, \$38,000 per day

Guidance from past and existing services suggests:

- A new shuttle vehicle must be friendly and attractive to tourists and residents. Windows should not be obstructed with decals. The design of the 'old-time' trolleys operated by the city on an as-needed basis (to shuttle cruise line tourists and AHA! patrons, for example) are reported to be popular with the public.
- A new shuttle service must provide equal access and opportunity for all who wish to ride while maintaining a clean and friendly atmosphere. Policy and enforcement must address potential abuse of the shuttle.

- The shuttle service must be financially sustainable, though it may be possible to operate a free or near-free shuttle service depending on costs and alternative revenue sources.

Preliminary Transportation Concepts

Overview

This section presents six preliminary transportation concepts for possible shuttle systems in New Bedford. The purpose of developing these concepts was to engage stakeholders in a discussion of which alternative concept had the most merit in terms of destinations served, level of service, and cost to operate at a route planning workshop.

In addition to presenting the six transportation concepts, this section presents a simple spreadsheet model that the Volpe Center developed to compare each concept's service characteristics. Based on a handful of inputs, the model estimates service characteristics for each concept as well as the concept's estimated annual operating cost.

Preliminary Transportation Concept Descriptions

The six concepts were grouped into two types: Alternative Concept 1 (A, B, and C) and Alternative Concept 2 (A, B, and C). Alternative Concept 1 focuses on providing service to, and connecting attractions in downtown New Bedford. Alternative Concept 2 focuses on connecting downtown to surrounding attractions. While routes in line with alternative concept 1 had been discussed since the initiation of the project, the Volpe Center developed the alternative concept 2 routes in response to a teleconference with key stakeholders who expressed interest in having the service connect to more remote destinations, namely Fort Taber Military Museum and Buttonwood Park Zoo.

Alternative Concept 1A connects the downtown with Whale's Tooth Parking Lot (WTPL), the State Pier, and the Rotch-Jones-Duff House. The shortest route serving these destinations is estimated to cover approximately 2.7 miles. Alternative Concept 1B connects the downtown with the State Pier and the Rotch-Jones-Duff House. The shortest route serving these destinations is estimated to cover approximately 1.8 miles. Alternative Concept 1C connects the downtown with the Rotch-Jones-Duff House. The shortest route serving these destinations is estimated to cover approximately 1.5 miles.

Alternative Concept 2A connects the downtown with WTPL, the State Pier, Buttonwood Park and Zoo, Fort Taber, and the Rotch-Jones-Duff House. The shortest route serving these destinations is estimated to cover approximately 11.3 miles. Alternative Concept 2B connects the downtown with the State Pier, Buttonwood Park and Zoo, Fort Taber, and the Rotch-Jones-Duff House. The shortest route serving these destinations is estimated to cover approximately 10.5 miles. Alternative Concept 2C connects the downtown with Buttonwood Park and Zoo, Fort Taber, and the Rotch-Jones-Duff House. The shortest route serving these destinations is estimated to cover approximately 2.7 miles.

Service Characteristics

The Volpe Center estimated service characteristics for each alternative concept for shuttle service in New Bedford using a simple spreadsheet model shown in Figure 28. A handful of service inputs (represented in yellow) and performance assumptions (represented in blue) are utilized to estimate service characteristics for each concept as well as each concept's estimated annual operating cost. The model calculates the estimated annual operating cost based on the hours in operation per day, days in operation, weeks in service per year, the number of buses necessary to run the route, and estimated hourly operating cost.

Figure 28
Spreadsheet model for Alternative Concept 1C

Source: The Volpe Center

Number of Stops		6				
	Distance	Average Speed	Estimated Run Time (Min)	Estimated Dwell Time (Min)	Assumed Layover Time (Min)	Total Running Time (Min)
Weekday	1.5	10	9	2	3	14
Saturday	1.5	10	9	2	3	14
Sunday	1.5	10	9	2	3	14

Type of Service	Hours of Operation			Days of Operation	Assumed Running Time (Min)	Desired Headway (Min)	Calculated Number of Buses	Number of Buses	Service Hours
	Begin	End	Total						
Weekday	8.00	20.00	12	5	14	15	0.93	1	60
Saturday	8.00	20.00	12	1	14	15	0.93	1	12
Sunday	8.00	20.00	12	1	14	15	0.93	1	12
Total Hours Per Week									84

Weeks in Service per Year	52
Annual Service Hours	4,368
Estimated Operating Cost (\$/hr)	\$ 55
Annual Operating Cost	\$240,240

Table 8 presents sample inputs and service estimates for each of the alternative concepts. As an example of how the model works, the desired headway was set to the least five-minute increment that would allow one bus to reasonably serve the given route length and number of stops. As expected with these parameters, shorter route distances allow for more frequent headways.

Table 8
Estimated service characteristics

Source: The Volpe Center

	Service Characteristic	Concept 1A	Concept 1B	Concept 1C	Concept 2A	Concept 2B	Concept 2C
INPUT	Number of stops	6	6	6	8	8	8
	Distance of route (miles) ^{xxiii}	2.7	1.8	1.5	11.5	10.5	10.3
	Average speed (MPH)	10	10	10	20	20	20
	Hours in operation per day	12	12	12	12	12	12
	Days in operation	7	7	7	7	7	7
	Weeks in service per year	52	52	52	52	52	52
	Operating cost per hour ^{xxiv}	\$55	\$55	\$55	\$55	\$55	\$55
ESTIMATE	Run time (min.)	16	11	9	35	32	31
	Dwell time (min.)	2	2	2	3	3	3
	Layover time (min.)	3	3	3	3	3	3
	Total run time (min.)	21	16	14	40	37	37
	Desired headway (min.)	25	20	15	45	40	40
	Number of buses necessary	1	1	1	1	1	1
	Service hours per week	84	84	84	84	84	84
	Annual service hours	4,368	4,368	4,368	4,368	4,368	4,368
	Annual operating cost	\$240,240	\$240,240	\$240,240	\$240,240	\$240,240	\$240,240

Based on the inputs shown in Table 8, Table 9 presents changes in the annual operating cost per unit changes of inputs on which the annual operating cost is calculated. This information is valuable for stakeholders to see the financial impacts of individual service changes.

Table 9
Estimated changes in annual operating cost per unit change in various service characteristics

Source: The Volpe Center

One Unit Change in each Service Characteristic...	...Equates to this Change in the Annual Operating Cost
+/- one hour of operation per day	+/- \$20,020
+/- one day in operation per week	+/- \$34,320
+/- one week in service per year	+/- \$4,620
+/- number of buses necessary per year	+/- \$240,240
+/- dollar of operating cost per hour	+/- \$4,368

Route Planning Workshop

Overview

Working with the park, the Volpe Center designed and held a half-day route planning workshop with park partners and other local stakeholders in June 2009. The purpose of the workshop was to discuss the preliminary transportation concepts and to work with stakeholders to design their preferred concepts. Input from the participants at this workshop informed the development of the refined transportation concepts.

Several objectives were set in advance of the route planning workshop:

- Assure local stakeholders identified as critical to the success of a pilot transit service are represented.
- Maximize interaction among stakeholders and park staff.
- Assure the park's interests in improving transit access and mobility between its units are secured in any planning and design proposals developed by the stakeholders in the workshop.
- Design the workshop to elicit preferences and priorities by the stakeholders with respect to route alignment and station stops.
- Design the workshop to elicit expert local context and knowledge for traffic conditions, traffic patterns, visitation patterns, street network connectivity, and parking and loading zone congestion.
- Strengthen partnerships between the park and local stakeholders to implement a financially sustainable pilot transit service.

The park and the Volpe Center identified a core set of partners and local stakeholders. The park sent an invitational email with the existing conditions section of this report attached. Following a presentation of the transportation concepts to the participants, the Volpe Center led a discussion of service needs including potential users, necessary stops, frequency, hours of operation, etc. and possible vehicle types. During the second half of the workshop, participants split into two groups to map out their desired routes. Park staff participated in each group and Volpe Center staff drifted among the groups as necessary. Each group was provided with large maps of the area, colored markers, and lists of the recently-determined service needs. At the end of the workshop, each group presented their desired routes to each other, and discussed similarities and differences.

Group discussion of service characteristics

Potential users

The group as a whole brainstormed a list of potential riders of the proposed shuttle service. The list includes students, ferry riders, theatre goers, visitors to New Bedford (many of who are there just for the day), and transients.

Transients were described as a negative characteristic of the previous 'Catch the Whale' service. Meeting participants agreed that any new service should be used as a means of transportation and should not be used for loitering. Suggestions to deter improper usage include charging nominal fees, requiring riders to obtain passes at park attractions or show employee badges, increasing law enforcement, and installing security cameras. Some of these tactics were used at the bus depot with positive results. The final vehicle selection should also reflect this concern by using vehicles with open, inviting, and highly visible cabins.

After later discussing routing and schedule constraints, participants determined that students may not be a primary target group for the shuttle due to their travel times and needs. Some participants were adamant that ferry riders should be a prime target market for the new service.

Route considerations

Participants suggested destinations for a prospective shuttle route. A list of potential destinations and relevant discussion points is as follows:

- *Whaling Museum and NPS Visitor Center* – Both the Whaling Museum and NPS Visitor Center were suggested by participants to be key destinations of a proposed shuttle system.
- *Elm Street and Zeiterion Parking Garages* – The parking garages are underutilized facilities in close proximity to the downtown historic sites and may provide parking for users of the potential shuttle.
- *WTPL* – WTPL is not consistently named and signed. People in town refer to it as such, but it is signed as ‘Ferry Shuttle parking’. This can be confusing to visitors. Regardless, most ferry riders know to park here.
- *State Pier (Lower Level)* – State Pier was noted by participants to be a vital and central stop, especially to greet ferry passengers as they return from Martha’s Vineyard. Due to potential conflicts with a cargo ship that occasionally docks at the ferry terminal, participants suggested the shuttle not go beyond the lower section of the ferry terminal. The lower section is within the gated parking area of State Pier and is a short walk to the ferry terminal. It is also located near the schooner Ernestina.
- *Waterfront Visitor Center (Pier 3)* – One participant suggested creating a separate stop for the Waterfront Visitor Center which is located next to the lower section of State Pier.
- *New Hotel/Waterfront Grill (Homer’s Wharf)* – A new hotel and waterfront grill under construction on the waterfront was thought by participants to be an important destination for the shuttle.
- *Star Store / UMass Dartmouth* – The Star Store was suggested as a potential destination but one of less importance than the partner attractions of the park because it primarily serves students.
- *Rotch-Jones-Duff House and Garden Museum and Nathan and Polly Johnson House* – These attractions were both suggested as potential destinations, particularly the former as it is a key attraction of the park.
- *Future Commuter Rail Station* – Participants suggested the future commuter rail station as a potential destination. Others questioned when and where the station would be located, and the group agreed that shuttle service should be planned for current non-rail conditions. The service may be altered later to accommodate commuter rail.
- *Fort Taber/Military Museum and Buttonwood Park Zoo* – Fort Taber and Buttonwood Park Zoo were discussed as potential stops but understood by all to be far from the downtown area relative to the short distances between the other destinations. Most participants seemed to acknowledge the trade-off between service frequency and service coverage.

Participants discussed the goals of the service and the route itself. Some suggested the shuttle would not have to be simply transit service from one point to another but is a potential opportunity for interpretation as well. The shuttle could be used to orient visitors to New Bedford and educate them regarding the city’s history, sites, stores, and places to visit. Members of the group suggested the following locations as additional stops or points of interest:

- Hurricane barrier and gates
- Beaches
- Bike path along Rodney French Boulevard
- Hazelwood Park
- Antique stores and New England Demolition and Salvage (NEDS)
- Washington Square (near County St.)
- Mansions (near Hawthorne St.)
- Veterans Memorial (in Buttonwood Park)

Based on the interest in connecting both downtown destinations and area-wide destinations such as Buttonwood Park and Fort Taber, and given the inherent trade-off of service frequency and number of

destinations, the group considered two routes (consistent with the preliminary transportation concepts): a short downtown route and a long area-wide route.

Schedule considerations

Participants considered the hours of operation for the shuttle system. The group noted the first ferry departs at 6:30am and the first classes at UMass begin at 8:00am. Ultimately, participants decided that beginning the service very early and running it very late may not be worth the service costs. Instead, they decided to focus on the period between 8:00am and 6:00pm.

Participants agreed that the schedule should be easy to understand and decided that a single consistent schedule throughout the week would be most effective. Several participants commented that the shuttle should initially offer the broadest service possible. With time, usage patterns can then be monitored and the service can be adjusted as necessary. Participants did note that there were opportunities to provide seasonal variation in the schedule. For example, tourism is highest in the summer, and there is a great deal of activity at Buttonwood Park during the winter school break.

Participants largely agreed that the short downtown route should operate with no more than thirty minute headways. However, the group agreed that fifteen to twenty minutes would be ideal. The consensus the long area-wide route was that headways should remain below forty minutes.

Funding

The practicality of defining service characteristics without first discussing funding and associated financial constraints was of particular interest to a couple of participants. One participant responded that they should continue to work on the concept; and that by doing so would provide more opportunities to cultivate stakeholders, champions, and potential funding sources over time. The participant continued by saying that a collaborative process would demonstrate support for the shuttle and give decision makers a clear picture of how much funding is needed to meet service requirements.

Another participant questioned whether business stakeholders should be included in the process as an additional community partnership with which to seek financial support. The participant theorized that businesses might be willing to support the system if they believed the service would benefit them. Another participant noted that a similar pitch had been made to the businesses at the mall when a new SRTA route was under development. All but one of the business owners declined to participate.

Operations and maintenance

The President of the Union Street Bus Co. and operator of SRTA made several recommendations regarding maintenance issues posed by hybrid diesel/electric and compressed natural gas (CNG) technology. First, he noted that most bus mechanics in New Bedford are not familiar with much of the new technology inherent to alternative fuel vehicles. He suggested investing in a technology that may easily be repaired. Second, he noted that his experience with hybrid diesel/electric buses in New Bedford have been less than satisfactory. Third, he noted that it is vitally important to have a backup bus to provide service if (and when) the primary vehicle requires service.

Participants also noted that specially designated bus stops and signs will be necessary to assist with traveler wayfinding and suggested the possibility of installing GPS and TV monitors at key passenger locations including the NPS Visitor Center, state pier, and the zoo to provide waiting passengers with real-time data. Some participants expressed uneasiness regarding children on the buses given the absence of seatbelts.

Small group route development

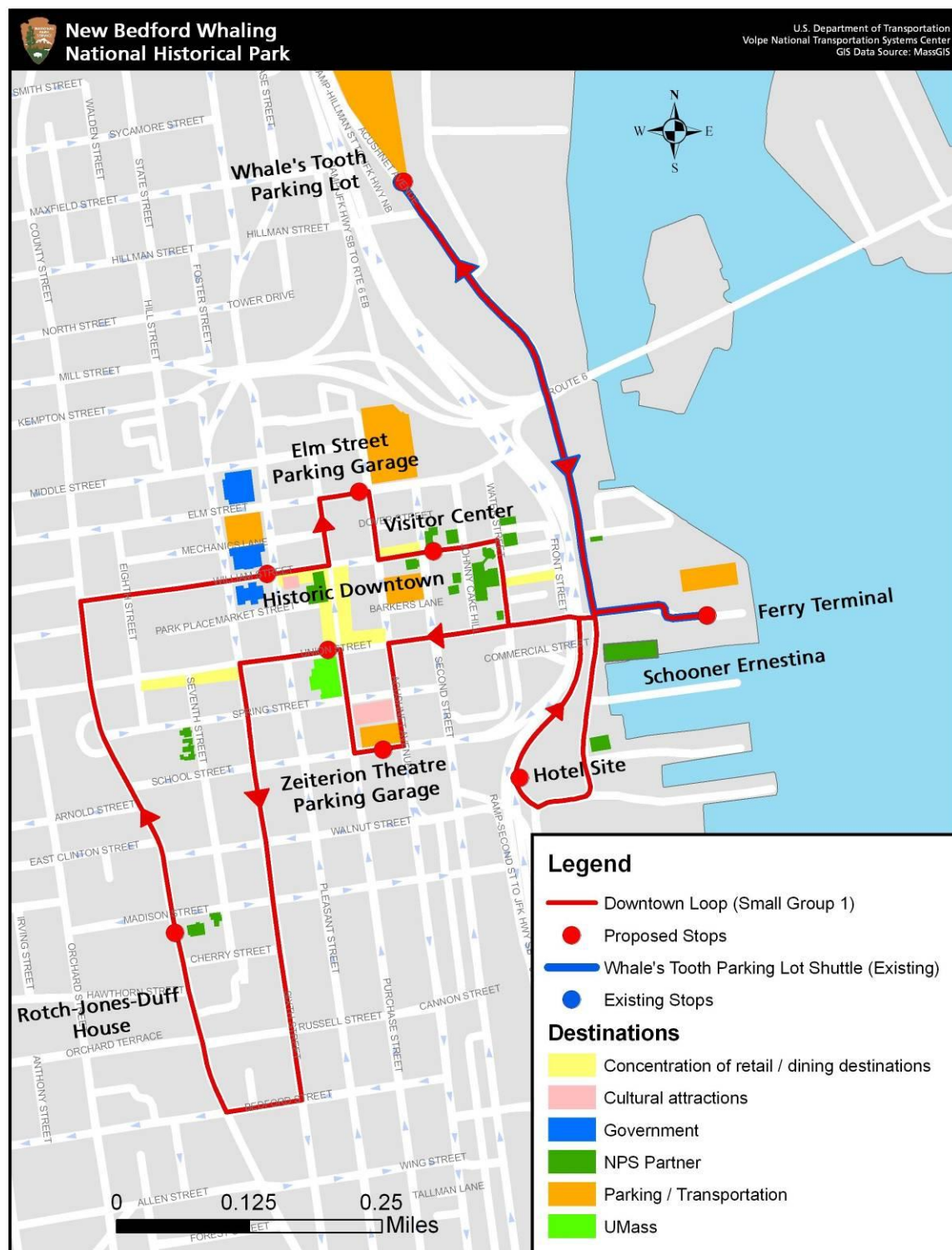
Following a brief lunch, participants were divided into two groups of six (Groups 1 and 2). Each group was given several markers and two maps: one map of downtown New Bedford and one of the greater New Bedford region. The discussion of service characteristics was recorded on flip charts; these sheets were

displayed so each group could see them. The groups were then asked to generate two routes each – one for downtown, and one for the surrounding area.

Downtown route

Small Group 1 assumed the NPS Visitor Center is where visitors come to orient themselves with the park and, to a lesser extent, New Bedford. As such, group 1's downtown route, transcribed from paper and represented in Figure 29, conceptually 'begins' at the visitor center. The route travels to WTPL, State Pier, and the site of the new hotel and grill near Homer's Wharf before heading to the Zeiterion and the Star Store, the Rotch-Jones-Duff House and Garden Museum and Nathan and Polly Johnson House, city hall and the library, the Elm Street parking garage, and returning to the NPS Visitor Center. Small Group 1 operated under the assumption that shuttle customers would not want a separate shuttle to WTPL because they would not want to transfer.

Figure 29
Proposed route: Group 1 Downtown
 Source: The Volpe Center and Small Group 1



Small Group 2 conceptualized the ‘start’ of its downtown route, shown in Figure 30, as State Pier because this is where ferry passengers begin and end their trips to Martha’s Vineyard. Ferry passengers are important consumers for the shuttle to target. The shuttle then goes directly to the NPS Visitor Center. From there, the shuttle passes several other park attractions before making its way to the Rotch-Jones-Duff House and Garden Museum and the Nathan and Polly Johnson House. The route passes by city hall, the library, and several retail areas before returning to the NPS Visitor Center and State Pier.

Several considerations guided Small Group 2’s decision making. The group decided that the new hotel site is within walking distance of State Pier and chose not to place a stop there. Small Group 2 also chose not to visit WTPL because there is already connecting service to the lot and overlapping service might inconvenience or confuse customers not parked there. Their decision was also influenced by anecdotal evidence that passengers would rather travel from WTPL to the ferry terminal and safely drop off their luggage with the ferry operator before visiting the historic sites of New Bedford.

Figure 30
Proposed route: Group 2 Downtown
 Source: The Volpe Center and Small Group 2



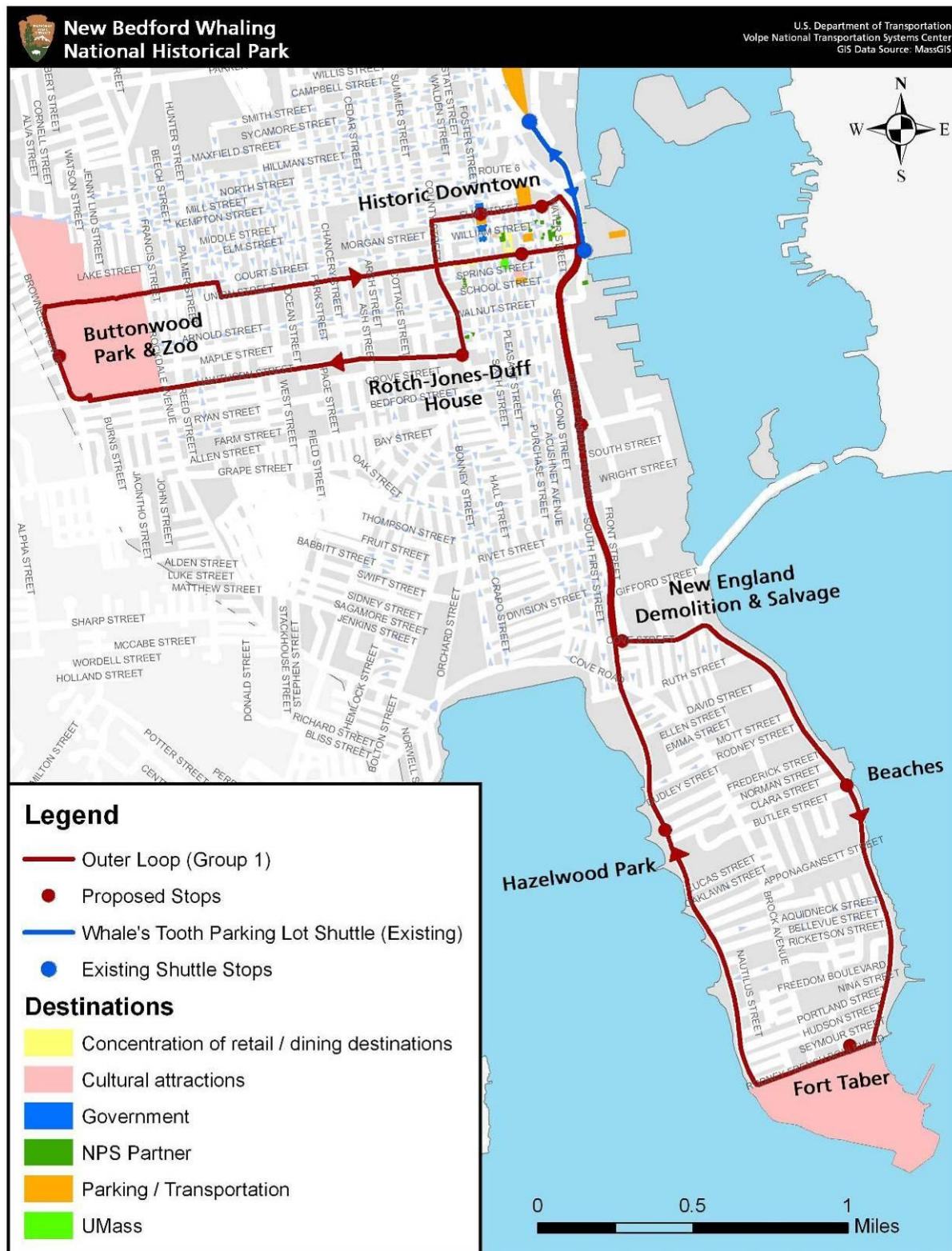
Wide-area route

Small Group 1's wide-area route, represented in Figure 31, also 'begins' and 'ends' at the NPS Visitor Center. The route heads down John F. Kennedy Highway and makes a loop around the peninsula, visiting the storm wall, beaches, and Fort Taber Military Museum along the way. After completing the peninsula loop, the shuttle continues back to the downtown area, runs past the Elm Street parking garage, and continues south along County Street. After heading west along Hawthorn Street, the shuttle visits Buttonwood Park Zoo and returns to the NPS Visitor Center via Union Street.

Figure 31

Proposed route: Group 1 Wide-area

Source: The Volpe Center and Small Group 1



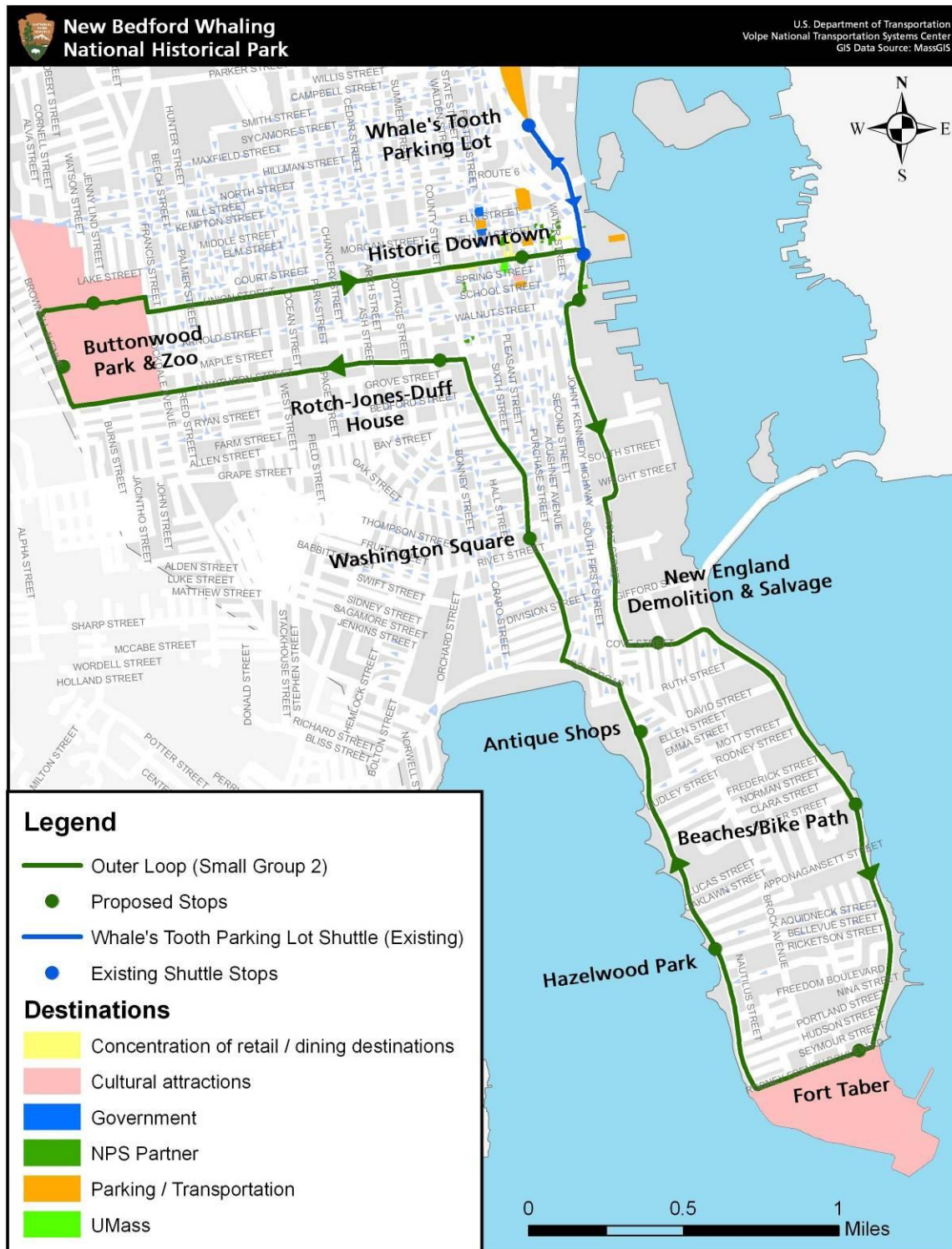
For the wide-area route, shown in Figure 32, Small Group 2 began with the notion that the route should provide a cultural and interpretive overview of New Bedford. Thus, after again beginning at State Pier, the group chose to follow McArthur Drive instead of Kennedy Highway. McArthur Drive passes through an industrial district, home to many marine-related businesses. The route continues south past the seawall, several beaches, and Fort Taber Military Museum. The route continues north along the west coast of the peninsula past a district of town known for antique shops. Next, the route continues north to within a block of the Rotch-Jones-Duff House and Garden Museum. Finally, the route continues west along Hawthorn before cutting back east through Buttonwood Park Zoo returning downtown and State Pier via Union Street.

Small Group 2 also suggested including common or nearby stops between its downtown and wide-area routes that would allow passengers to change routes easily. Opportunities for connections occur near the Rotch-Jones-Duff House and Garden Museum and at several points along Union Street downtown.

Figure 32

Proposed route: Group 2 Wide-area

Source: The Volpe Center and Small Group 2



Transportation Concepts Analysis

The small group downtown and wide-area routes are analyzed qualitatively and quantitatively below.

Proposed downtown routes qualitative analysis

Strengths of Group 1's proposed downtown route are that it serves a wide variety of locations, including WTPL and the site of the new hotel, and it provides direct access to both downtown parking garages. Ferry passengers who park at WTPL and wish to travel downtown would not have to take two separate buses, connecting at State Pier.

A disadvantage of Group 1's proposed downtown route is that visitors riding from the Visitor Center to other park attractions, namely the Rotch-Jones-Duff House and Garden Museum, would first have to take a 1.5 mile detour to State Pier, WTPL, and the site of the new hotel. The utility of these stops to the overall route depends on how many riders require access to these destinations. In addition, the bus stop at the Elm Street parking garage is nearly as far from the main pedestrian entrance of the garage as from the NPS Visitor Center. The route going to and from the Rotch-Jones-Duff House and Garden Museum does not stop at any other attractions, particularly the Nathan and Polly Jones House. The route misses key aggregations of retail establishments, particularly those along Union Street between Sixth Street and Eighth Street and those along Purchase Street between Union Street and William Street.

A strength of Group 2's proposed downtown route is that it is a relatively short route with stops at or near almost all key destinations. It stops at the Rotch-Jones-Duff House and Garden Museum and directly passes the Nathan and Polly Jones House.

A weakness of Group 2's proposed downtown route is that it may be confusing for riders boarding at the NPS Visitor Center. Buses leaving the Visitor Center may be traveling to either State Pier or the Zeiterion Garage, depending on the stage in their route. To avoid confusion, this would have to be communicated clearly to riders. Another weakness is that the service does not stop directly in front of the Elm Street Garage. The route does not serve WTPL, forcing customers who park there to first take the existing ferry shuttle and transfer at State Pier. The route does not serve the site of the new hotel. The route stops in the back of Star Store. The route misses key aggregations of retail establishments, particularly those along Union Street between Sixth Street and Eighth Street and those along Purchase Street between Union Street and William Street.

Proposed wide-area routes qualitative analysis

A key strength of Group 1's proposed wide area route is that it stops in downtown before and after going to both Fort Taber Military Museum and Buttonwood Park Zoo. Thus, it allows customers to ride to and from Fort Taber Military Museum and downtown or Buttonwood Park Zoo and downtown, but does not force them to ride to both the fort and the park. This route also provides many options for connecting to any potential downtown route.

The trade-off against this strength is that the route is longer than one that might connect Fort Taber Military Museum and Buttonwood Park Zoo directly. It covers many of the stops that would also be covered by a downtown route.

A key strength of Group 2's proposed wide area route is that it is scenic and does not travel on the same roads traveling either to or from Fort Taber Military Museum or Buttonwood Park Zoo. It is comparatively shorter than Group 1's proposed route and provides for connections with a downtown shuttle without creating significant service overlap.

A weakness of Group 2's proposed route is that it is a relatively large circuit that requires riders to travel between downtown, Fort Taber Military Museum, and Buttonwood Park Zoo sequentially.

Quantitative route analysis

Routes proposed by the small groups were analyzed using the spreadsheet model described earlier in the report. Routes based on the proposed routes but also including additional service to the Military Museum at Fort Taber were analyzed as well. Key assumptions are explained as follows:

- Average speed for the downtown area is ten miles per hour, while average speed for the wide-area is 20 miles per hour due to fewer traffic signals and less congestion.
- A downtown service may run year round, while a wide-area service which stops at outdoor destinations such as Fort Taber Military Museum and Buttonwood Park Zoo may only run during the warmer half of the year.
- The standard operating cost per hour of transit systems is between \$45 and \$65 per hour, thus \$55 may be used for this model.
- Dwell times may be longer at stops for WTPL because ferry passengers may embark or disembark with heavy luggage.

Inputs and estimates of the models are shown in Table 10.

Table 10
Estimated service characteristics

Source: The Volpe Center

	Service Characteristic	Downtown			Wide-area			
		Group 1	Group 2	Group 2 + WTPL	Group 1	Group 1 + WTPL	Group 2	Group 2 + WTPL
INPUT	Number of stops	7	7	8	7	7	8	8
	Distance of route (miles) ^{xxv}	3.7	1.9	3	10.9	11.9	9.7	10.7
	Average speed (MPH)	10	10	10	20	20	20	20
	Hours in operation per day	10	10	10	10	10	10	10
	Days in operation	7	7	7	7	7	7	7
	Weeks in service per year	52	52	52	26	26	26	26
	Operating cost per hour ^{xxvi}	\$55	\$55	\$55	\$55	\$55	\$55	\$55
ESTIMATE	Run time (min.)	22	11	18	33	36	29	32
	Dwell time (min.)	2	2	3	2	2	3	3
	Layover time (min.)	3	3	3	3	3	3	3
	Total run time (min.)	28	17	24	38	41	35	38
	Desired headway (min.)	30	20	25	40	45	35	40
	Number of buses necessary	1	1	1	1	1	1	1
	Service hours per week	70	70	70	70	70	70	70
	Annual service hours	3,640	3,640	3,640	1,820	1,820	1,820	1,820
	Annual operating cost	\$200,200	\$200,200	\$200,200	\$100,100	\$100,100	\$100,100	\$100,100

As shown in Table 10, because operating cost per hour is assumed to be \$55 and service hours per week are 70 for all routes, the main determinant of annual operating cost is weeks in service per year. Given 52 weeks of operation per year, all downtown scenarios are modeled to cost \$200,200. Given 26 weeks of operation per year, all wide-area scenarios are modeled to cost \$100,100. Given equal costs, the key distinguishing feature within categories is headway, which is indirectly proportional to frequency of service.

Of the downtown routes, Group 2's route has the least headway of 20 minutes, allowing for 3 bus runs per hour, or 30 bus runs per day. Group 1's route has a headway of 30 minutes allowing for 2 bus runs per hour, or 20 bus runs per day. Adding a stop at WTPL to Group 2's provides a headway of 25 minutes, 2.4 bus runs per hour, or 24 bus runs per day.

Of the wide-area routes Group 2 has the least headway of 35 minutes, allowing for 1.7 bus runs per hour, or 17 bus runs per day. Group 1's route and Group 2's route with additional service to WTPL both have headways of 40 minutes, or 1.5 bus runs per hour and 15 bus runs per day. Group 1's route with additional service to WTPL has an estimated headway of 45 minutes, or 1.3 bus runs per hour and 13 bus runs per day.

Refined Transportation Concept

Overview

This section presents a refined transportation concept for a potential shuttle system to serve the New Bedford Whaling National Historical Park. The refined concept is the result of stakeholder input and research performed by the Volpe Center study team. A significant portion of the refined concept evolved from the route planning workshop in which key stakeholders shared preferences regarding schedule, operations, vehicle selection, and route. This section reflects those preferences combined with additional observations and analysis by the Volpe Center study team. The proposed shuttle service should consist of a downtown route and potentially a wide-area route. These loops may be co-branded with existing shuttle systems and for the purposes of this paper will be referred to as the Downtown LOOP and the Outer LOOP. The ferry shuttle serving the State Pier and the WTPL could be termed the Ferry LOOP.

Users

The proposed shuttle will serve visitors to the national park such as passengers arriving and departing ferries, tourists, residents of New Bedford, and to a lesser extent, students of UMass Dartmouth. Each projected user seeking transportation from one point along the route to another should be welcome. Users seeking to use the shuttle for purposes other than transportation, including shelter, solicitation, or loitering, should be prohibited and subject to removal by police. It is currently not possible to project the estimated ridership without first implementing a broad survey of potential users. Ridership also depends on how well the service would be publicized or marketed. Examining a similar system to gain an understanding of potential ridership would not be very valuable due to the uniqueness of the factors influencing the potential service.

Service Characteristics

As suggested by the stakeholders, the shuttle(s) should run continuously between 8:00am and 6:00pm seven days a week. The Downtown LOOP should take roughly 20 minutes to complete and would circulate three times per hour or 30 times per day. The Outer LOOP should take roughly 40 minutes to complete and would circulate 1.5 times per hour or 15 times per day. While the Downtown LOOP should operate year-round, the Outer LOOP should operate six months of the year (April to October). These consistent service characteristics would help shuttle riders and people promoting the shuttles to quickly become familiar with the routes and enable them to understand the service as a dependable form of transportation.

The proposed shuttle should be driven by knowledgeable bus drivers with pre-existing or learned knowledge of both the national historical park and New Bedford sites of interest. The shuttle should be fare-free for all riders seeking transportation among points along the route. Strict police enforcement will be required to remove non-compliant riders. The shuttle service should be consistently marketed to potential riders via print and online media. The service should be co-branded but differentiated from other successful shuttle services in New Bedford including the UMass LOOP and the Ferry LOOP.

Vehicles

The shuttle vehicle(s) should be clean and inviting to potential riders. Windows should be transparent with minimal tinting. Vehicle technology must be compatible with local maintenance skills and abilities. Vehicle fuel type must be determined by an analysis of cost and proximity to fuel sources. See Appendix A for a more complete discussion of potential vehicles and fuels. The shuttle vehicle must have a back-up vehicle to be used during periods of maintenance and breakdowns.

Routes

Downtown LOOP

Downtown routes proposed by the small groups at the route planning workshop are shown in Figure 33. The refined concept for the Downtown LOOP is shown in Figure 34.

Figure 33
Proposed downtown routes: Small Groups 1 & 2
 Source: The Volpe Center and Small Groups 1& 2



Figure 34
Refined concept: Downtown LOOP
 Source: The Volpe Center



The refined Downtown LOOP concept begins at the NPS Visitor Center and travels down William Street to Water Street. At Union Street, the route turns left and crosses Route 18 into the lower parking lot of State Pier. At this point, passengers may connect to either the Ferry LOOP shuttle or the Martha's Vineyard or Cuttyhunk ferries. The route then returns up Union Street and stops at the foot of Johnny Cake Hill at Bethel Street where ferry passengers may disembark and reach the New Bedford Whaling Museum, the Seamen's Bethel, the Mariners Home, and the NPS Visitor Center. The route turns left on Acushnet Avenue, right on School Street, and right on Purchase Street where it stops first at the Zeiterion Theatre and parking garage and second at the Star Store. Riders may choose to connect to the UMass Dartmouth LOOP at Star Store. The route turns left on Union Street and left on Sixth Street. At Cherry Street, the route turns right and right again at County Street to stop at the Rotch-Jones-Duff House and Garden Museum. The route returns to Union Street via Madison Street and Seventh Street, passing the Nathan and Polly Jones House and stopping at Union Street. It continues on Union Street, makes a left on Pleasant Street, and stops at the intersection of William Street near the library, art museum, bus terminal, and various shops and restaurants. The route continues on William Street, turns left on Purchase Street, right on Elm Street, and stops at the Elm Street garage before returning to the NPS Visitor Center via Acushnet Avenue and William Street.

Similarities between the small group routes and the refined Downtown LOOP route are:

- **The immediate downtown.** The immediate downtown route is roughly the same in the refined Downtown LOOP route as it is for Small Group 1 and similarly avoids a potentially confusing "double stop" at the visitor center.
- **State Pier and The Rotch-Jones-Duff House and Garden Museum.** The refined Downtown LOOP route to State Pier and The Rotch-Jones-Duff House and Garden Museum closely follow that of Small Group 2. The refined route avoids WTPL because it is served by the Ferry LOOP. The refined route avoids the new hotel site because it would only benefit hotel guests and it is within walking distance of State Pier.

Differences between the proposed routes and the refined Downtown LOOP route are:

- **Bus stop at Union Street and Seventh Street.** The refined Downtown LOOP route turns on Seventh Street and stops at the intersection with Union Street. This is to provide access to economic trip generators such as restaurants and retail establishments as well as the Nathan and Polly Jones House.
- **Bus stop at Star Store.** The refined Downtown LOOP route has a bus stop shared with the Star Store bus stop of the UMass Dartmouth LOOP.

The spreadsheet model used to estimate service characteristics of the small groups' proposed routes was applied to the Downtown LOOP refined concept. Comparison of the model output is compared with those of the small groups' proposed routes in Table II. As shown in the table, the refined Downtown LOOP concept is comparable with Small Group 2's downtown route. The refined Downtown LOOP concept provides for 20 minute headways and makes two more stops than either of the small groups' preferred concepts.

Table 11
Estimated service characteristics

Source: The Volpe Center

	Service Characteristic	Downtown		
		Small Group 1 Downtown Route	Small Group 2 Downtown Route	Downtown LOOP Refined Concept
INPUT	Number of stops	7	7	9
	Distance of route (miles)	3.7	1.9	1.9
	Average speed (MPH)	10	10	10
	Hours in operation per day	10	10	10
	Days in operation	7	7	7
	Weeks in service per year	52	52	52
	Operating costs per hour	\$55	\$55	\$55
ESTIMATE	Run time (minutes)	22	11	11
	Dwell time (minutes)	2	2	3
	Layover time (minutes)	3	3	3
	Total run time (minutes)	28	17	18
	Desired headway (minutes)	30	20	20
	Number of buses necessary	1	1	1
	Service hours per week	70	70	70
	Annual service hours	3,640	3,640	3,640
	Annual operating cost	\$200,200	\$200,200	\$200,200

Outer LOOP

Wide-area routes proposed by the small groups at the route planning workshop are shown in Figure 35. The refined concept for the Outer LOOP is shown in Figure 36. The refined concepts for the downtown LOOP and outer LOOP are shown together in Figure 37.

Figure 35
Proposed wide-area routes: Small Groups 1 & 2
 Source: The Volpe Center and Small Groups 1 & 2

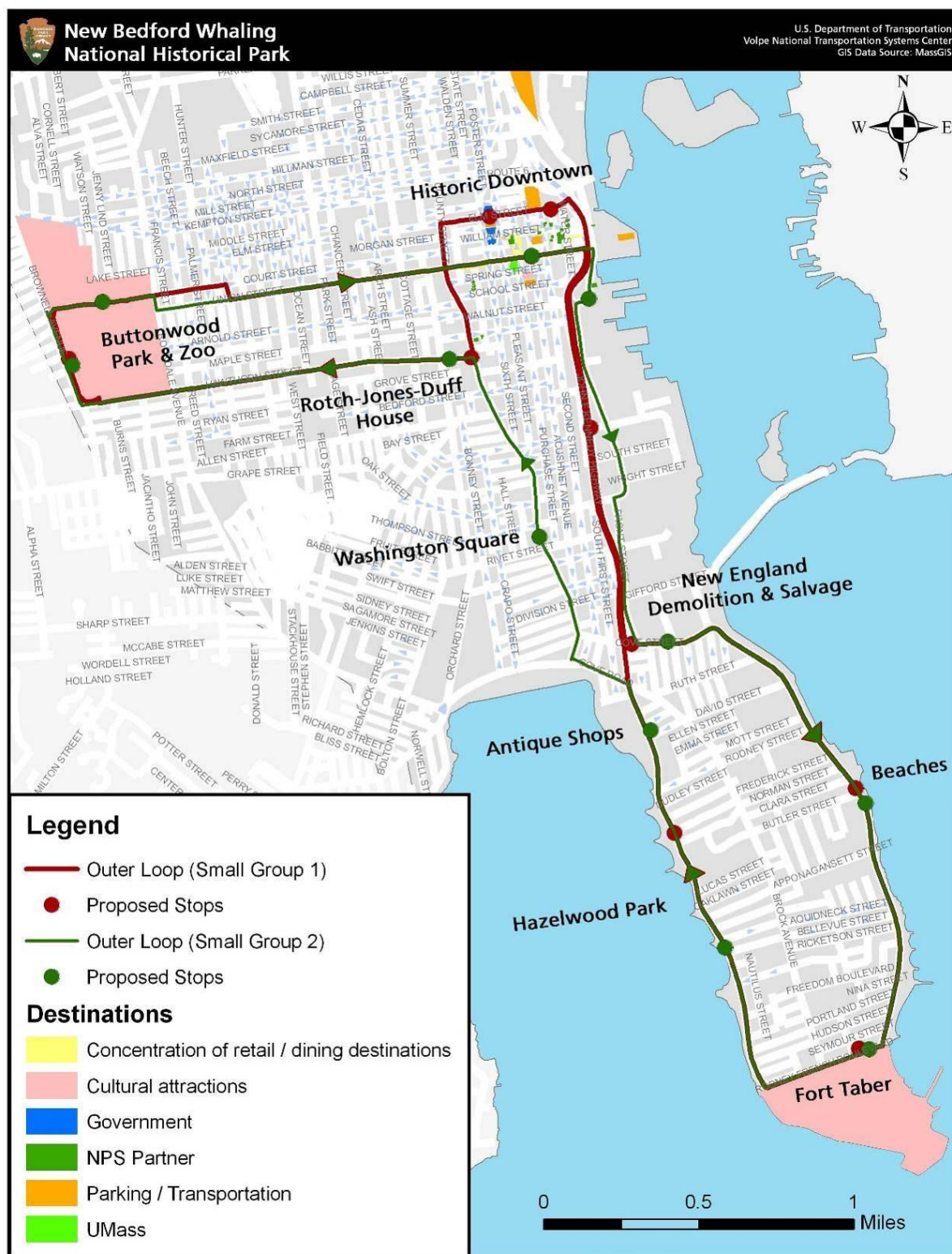


Figure 36
Refined concept: Outer LOOP
 Source: The Volpe Center



Figure 37
Refined concepts: Downtown LOOP and Outer LOOP
 Source: The Volpe Center



The refined Outer LOOP concept begins at State Pier and travels south along John F. Kennedy Highway. The route turns left on Cove Street where it could stop at New England Demolition and Salvage before continuing south along East Rodney French Boulevard. The route can stop at several beaches before entering Fort Taber and stopping at the Military Museum. The route continues west along Ferry Road and South Rodney French Boulevard before turning north along West Rodney French Boulevard and stopping at Hazelwood Park and a cluster of antique shops. The route then travels north along John F. Kennedy Highway and stops at points downtown including State Pier, Union Street and Bethel Street, Union Street and Seventh Street, and the Rotch-Jones-Duff House and Garden Museum. At these points, riders may connect to the Downtown LOOP. The route heads west to Buttonwood Park Zoo via Hawthorn Street before returning back east toward downtown on Court Street and Union Street.

Similarities between the small groups' proposed routes and the refined Outer LOOP route are:

- **Return to downtown.** The refined Outer LOOP route is similar to Small Group 2 by returning downtown both after stopping at Buttonwood Park Zoo and Fort Taber Military Museum. Accordingly, riders can visit one or the other without having to spend more time by riding to both.
- **East-west route.** The refined Outer LOOP route follows the suggestion of both small groups by taking Hawthorne Street west and Union Street east.
- **Connections.** Like the routes proposed by the small groups, the refined Outer LOOP route connects with the refined Downtown LOOP at key points including the Rotch-Jones-Duff House and Garden Museum, State Pier, and several points along Union Street (Figure 5).

Differences between the small groups' proposed routes and the refined Outer LOOP route are:

- **John F. Kennedy Highway.** The refined Outer LOOP route follows John F. Kennedy Highway traveling both north and south from the Fort Taber Military Museum. Doing so reduces trip time along the route.
- **Stop at Fort Taber Military Museum.** The refined Outer LOOP route stops at the Military Museum on East Rodney French Boulevard instead of stopping a quarter of a mile away along South Rodney French Boulevard on the fringe of the park surrounding Fort Taber Military Museum.

The spreadsheet model used to estimate service characteristics of the small groups' proposed routes was applied to the Outer LOOP refined concept. The model output for the Outer LOOP is compared with those of the small groups' proposed routes in Table 12. As shown in the table, the Outer LOOP provides two more stops than the small groups' propose routes yet maintains a 40-minute headway.

Table 12
Estimated service characteristics

	Service Characteristic	Wide-area		
		Small Group 1 Downtown Route	Small Group 2 Downtown Route	Downtown LOOP Refined Concept
INPUT	Number of stops	7	8	10
	Distance of route (miles)	11.9	10.7	11.9
	Average speed (MPH)	20	20	20
	Hours in operation per day	10	10	10
	Days in operation	7	7	7
	Weeks in service per year	26	26	26
	Operating costs per hour	\$55	\$55	\$55
ESTIMATE	Run time (minutes)	36	32	34
	Dwell time (minutes)	2	3	3
	Layover time (minutes)	3	3	3
	Total run time (minutes)	41	38	40
	Desired headway (minutes)	45	40	40
	Number of buses necessary	1	1	1
	Service hours per week	70	70	70
	Annual service hours	1,820	1,820	1,820
	Annual operating cost	\$100,100	\$100,100	\$100,100

Source: The Volpe Center

Conclusion and Next Steps

The refined concepts described in the preceding section are similar to the concepts provided by the small groups. However, in the refined shuttle concepts, the Volpe Center altered the small group concepts to be as efficient and cost-effective as possible by connecting to as many key destinations in as short of a distance as possible. The consistent service characteristics (days and hours of operation, frequency of service, etc.) defined by the small groups and the Volpe Center will help shuttle riders and people promoting the shuttles in quickly becoming familiar with the routes so that they can depend on the shuttles to get them where they want to go. While appealing primarily to visitors, the refined shuttle concepts will likely attract residents who want to travel to destinations along the route, including their homes and jobs. The refined concepts will help connect the key attractions of New Bedford to each other so that people who cannot or do not want to rely on their automobiles have another option when traveling around the city.

Piloting the system

Phased shuttle system implementation

The proposed shuttle system should be implemented in phases. Since funding sources are scarce, the Downtown LOOP should be implemented before the Outer LOOP since the Downtown LOOP will likely serve more people and more directly serves the park and its partners.

The Downtown LOOP should first be implemented as a one- or two-year pilot. While enough information might be available after one year to gauge the success of the system, a two-year pilot period would allow for additional data collection and any improvements to be made during the second year. Furthermore, if the data and observations from the first year show that the system is running successfully, more permanent funding sources can be pursued during the second year of the pilot, which could result in a seamless period of service between the pilot and more permanent phases.

During and after the pilot period, the system should be evaluated for its effectiveness, both in terms of cost and destinations served. Bus drivers and park partners should regularly be asked how the system is working and what opportunities they see for improvement. These observations should be recorded and reviewed at the end of the first and potential second year of the pilot. Changes to the route could then be made during the second year of the pilot period.

Data must be collected carefully and regularly during the pilot period. Most importantly, riders must be counted as soon as they board the bus at each stop. Count sheets should be provided to each bus driver. Count data should be summarized each month and sent to all relevant parties interested in the success of the system. Financial operations data must also be kept up-to-date and separate from the other New Bedford shuttle systems. This information should be readily available upon request.

Operation and maintenance cost estimates

Four options for operating the Downtown LOOP pilot are listed in Table 13. The park must select the option that is most reasonable given the interest and likelihood of partners funding the operations of the shuttle. If funding is very limited, then Option A would be the best choice. Conversely, if funding is available, then Option D would be the best choice. If a moderate amount of funding is available, Option B is probably a better choice than Option C since visitation during peak season on Mondays to Wednesdays is greater than from Thursdays to Sundays during the off-season. For each option, hours of operation are from 8:00 AM to 6:00 PM. For evaluating a pilot program, it is desirable to have as many days of data to analyze as possible. Accordingly, from an evaluation perspective, Option D would be ideal for at least the first year of a pilot program.

Option A: Seasonal Limited Service

- Days: Thursday to Sunday (four days)
- Months: April 15 to October 15 (six months)

- Cost: \$57,200

Option B: Seasonal Full Service

- Days: Monday to Sunday (seven days)
- Months: April 15 to October 15 (six months)
- Cost: \$100,100

Option C: Year-Round Limited Service

- Days: Thursday to Sunday (four days)
- Months: year-round (12 months)
- Cost: \$114,400

Option D: Year-Round Full Service

- Days: Monday to Sunday (seven days)
- Months: year-round (12 months)
- Cost: \$200,200

Table 13
Estimated service characteristics
Source: The Volpe Center

	Service Characteristic	Option A	Option B	Option C	Option D
INPUT	Number of stops	9	9	9	9
	Distance of route (miles)	1.9	1.9	1.9	1.9
	Average speed (MPH)	10	10	10	10
	Hours in operation per day	10	10	10	10
	Days in operation	4	7	4	7
	Weeks in service per year	26	26	52	52
	Operating cost per hour ^{xxvii}	\$55	\$55	\$55	\$55
ESTIMATE	Run time (min.)	11	11	11	11
	Dwell time (min.)	3	3	3	3
	Layover time (min.)	3	3	3	3
	Total run time (min.)	18	18	18	18
	Desired headway (min.)	20	20	20	20
	Number of buses necessary	1	1	1	1
	Service hours per week	40	70	40	70
	Annual service hours	1,040	1,820	2,080	3,640
	Annual operating cost	\$57,200	\$100,100	\$114,400	\$200,200

As discussed at the workshop, the funding for the operations and maintenance of the shuttle might be covered by the City of New Bedford/HDC since one of HDC's routes – the route that circulates through the city on request and serves the ferry terminal and Whale's Tooth Parking Lot – could be reconstituted to run regularly along the Downtown LOOP route. This possibility needs to be discussed in more detail between the park, park partners, the City of New Bedford, and HDC.

Shuttle bus cost estimate

In February 2009, the city of New Bedford submitted a proposal for funding two buses through the Paul S. Sarbanes Transit in Parks (TRIP) Program. This proposal requested \$440,000 for two buses. Two buses could be used in several ways. The safest use for the second bus would be to have it available as a back-up bus to be used as needed. Another option would be for the park and its partners to decide to run both buses on the Downtown LOOP to reduce the headway from 20 minutes to 10 minutes. This increase in frequency would, however, double the estimated operating costs in Table 13. The last possibility would be to operate the second bus on the Outer LOOP as a pilot. Because the ridership for this route would likely be low compared to the Downtown LOOP and funding sources are limited, this option is not scoped as part of the pilot period.

According to the vehicle costs described in Appendix A, a budget of \$220,000 per bus would yield a Standard Item 342 (Figure 38), which is a cutaway model available through the General Services Administration. The capacity of this vehicle is 16 adults and a parallel hybrid electric variant power train system is available and included in the \$189,974 quoted price. If funds can be leveraged and more than \$220,000 would be available per bus, hybrid or diesel (that could run on biodiesel) transit buses (as opposed to cutaways) are available for \$230,000 to \$360,000 (see Appendix A for more detail).

Figure 38
Standard Item 342 (note that an advertising wrap is not recommended for New Bedford's shuttle)

Source: General Services Administration



If the TRIP program proposal is not funded, more affordable options are available. Most significantly, the GatorMoto micro electric bus costs \$22,000 and accommodates 14 passengers, or nine or 11 with a wheelchair.

Marketing

In order for the shuttle to reach its greatest potential, a comprehensive marketing effort must be conducted. All partners must be involved in and committed to marketing the shuttle system so that visitors will hear about and see information on the shuttle as soon as they visit any of the partners in the city. This marketing cost estimate is for the costs of developing and printing generating promotional materials, such as brochures, rack cards, and posters. Information about the shuttle should be added to partners' websites and front desk staff should be briefed about the shuttle and its service hours and frequency. It is expected that marketing coordination and outreach will be done by the shuttle program supervisor.

Bus stops

Nominal costs to cover creating bus stops for the shuttle service should also be considered. These costs will cover the creation and installation of bus stop signs and benches, in coordination with the city.

Evaluation

At the end of the pilot program, an evaluation should be performed on the performance of the pilot. This evaluation should analyze and synthesize all available data and should include recommendations for improvement to the pilot program once the shuttle system is made permanent. Note that bus drivers or other staff must keep an up-to-the-minute stop-by-stop count of passengers coming on – and if possible off – of the bus and operations and maintenance cost records must be kept up-to-date.

Staffing

It is expected that a park staff person will be overseeing the start-up activities and ongoing operation of the shuttle service. It is expected that it will take an average of a quarter of a staff member's time before and during the pilot shuttle (less if it is a full year operation) to manage the shuttle and make sure it is successfully implemented. This cost will be borne by the park unit and is not part of the total funding request.

Summary

The table below summarizes the costs related to the expense items discussed above. These costs are estimates and should change depending on the final decisions of the park and its partners.

Table 14
Estimated service characteristics

Source: The Volpe Center

Item	Description	Qty	Unit	Unit Cost	Item Cost
Operation and maintenance	Annual cost needed to cover operation and maintenance	1	Lump	\$57,200 – 200,200	\$57,200 – 200,200
Shuttle buses	Costs of purchase of two shuttle buses	2	Each	\$220,000	\$440,000
Marketing	Marketing plan and promotional materials	1	Lump	\$10,000	\$10,000
Bus stops	Costs to cover nine bus stops, benches, and signs	9	Each	\$700	\$6,300
Evaluation	Cost to evaluate the success of the pilot program	1	Lump	\$12,500	\$12,500
Staffing	Staff oversight of start-up, operations and evaluation.	1/8*	Lump	\$6,250	\$6,250

* ¼ time over ½ of the year.

Appendix A: Alternative Fuel Vehicles

Purpose

This appendix outlines several potential alternative fuels and vehicle options available to the New Bedford Whaling National Historical Park (NHP) should the park and its partners procure funding and move forward with implementing a shuttle system in downtown New Bedford, MA, as described in the preceding report.

Background

The Volpe Center was tasked by New Bedford Whaling NHP to provide the park an analysis of various alternative fuel buses. In support of this request, the Volpe Center evaluated a number of fuel choices and vehicle options that fit within the specifications for travel demand and air quality in the region. This appendix discusses the results of the analysis and outlines the procurement planning process that would be undertaken to identify the type and model vehicle(s) that will best meet park needs.

As stipulated by the Energy Policy Act (EPACT) of 1992, the National Park Service (NPS) is required to use alternative fuel vehicles (AFVs) whenever possible. The use of AFVs is often in the best interest of the parks as they reduce vehicle emissions and air pollution. All NPS vehicles must comply with Section 504 of the Rehabilitation Act of 1973, the EPACT of 1992, federal “Buy America” requirements, federal Environmental Protection Agency (EPA) regulations (as well as state environmental requirements), and the Federal Motor Vehicle Safety Standards (FMVSS).

The analysis in this appendix has been undertaken to identify the type and model vehicle(s) that will best meet park needs while satisfying federal policies. A number of alternative fuel options have been evaluated as reasonable alternatives: methanol/ethanol, hydrogen, biodiesel, compressed natural gas (CNG), propane, and hybrid electric. The decision to select a particular fuel choice is dependent on several variables: local availability (access to distributor with fuel selection), current infrastructure (ability to reasonably dispense fuel), environmental concerns, and vehicle availability and cost.

The local availability of each of the alternative fuels and suggested changes to infrastructure are discussed below to provide background into the feasibility of using these fuels. Should a fiscal year 2009 grant application to the Paul S. Sarbanes Transit in the Parks program be successful, the budget for each vehicle would be \$220,000.

Methanol and ethanol

Methanol and ethanol are both alcohol-based fuels best suited for light-duty spark-ignition engines. Because of technological advances, these fuels have shown the ability to provide equivalent range and power as traditional fuel choices. While methanol and ethanol fuel based systems have shown potential in vehicle propulsion systems, only one test application has been conducted for transit service in the United States. Currently, no domestic bus manufacture is producing commercial methanol or ethanol propelled products.

A growing number of stations in the United States sell gasoline partially composed of ethanol such as E10 (10% ethanol, 90% gasoline) and E85 (85% ethanol, 15% gasoline). Most gasoline-powered vehicles can readily accept E10 fuel. E85 capable vehicles are growing in popularity among manufacturers. The majority of E85 stations are clustered in the Midwest, around the corn-based ethanol producing facilities. As such, only two gasoline stations in Massachusetts provide E85 gasoline, both in the Boston region.

Hydrogen

Hydrogen fuel cells are an emerging technology. A number of transit systems are currently experimenting with hydrogen fuel cells because of their zero-emission qualities and power capacity. However, the U.S. Department of Energy recently cut funding for hydrogen fuel cells, stating that the fuel source will not be a practical alternative over the next 10 or 20 years. Furthermore, modified transit buses equipped to

operate on hydrogen fuel, cost approximately \$1.2 million and the infrastructure to dispense hydrogen is essential. The capital costs associated with this technology are prohibitive and are out of New Bedford Whaling NHP's scope.

Biodiesel

Biodiesel is a renewable alternative fuel produced from a wide range of vegetable oils and animal fats. The content of biodiesel can vary widely from a 100% biodiesel fuel containing no petroleum, to a 20% biodiesel and 80% petroleum blend known as B20, to B10, and B5. Operationally, biodiesel blends (B20, B10, and B5) perform similarly to low sulfur diesel in terms of power, torque, and fuel efficiency, without major modification of engines or infrastructure. While biodiesel can be used in existing engines and fuel injection equipment with little impact to operating performance, it should be noted that fuel additives and/or garaging when not in use would become necessary in the colder winter months to prevent coagulation of B20 or greater in this climate. As the U.S. Department of Energy notes, "fleets must understand biodiesel fuel specifications and the proper ways to handle and store the fuel before embarking on any comprehensive plans to alter fuel choices^{xxviii}."

According to the U.S. Department of Energy, the nearest publicly accessible biodiesel refueling station in Massachusetts is Loud Fuel Company (552 Thomas Landers Rd.), located just over thirty-five miles away from New Bedford in Falmouth, MA. Fleetmaster (9 Hylestead St.) in Providence, RI, is slightly closer than Loud Fuel Co., at approximately 32 miles. However, it may be possible for a biodiesel supplier to truck biodiesel to a dedicated biodiesel tank for use in New Bedford.

Compressed Natural Gas (CNG)

The interest in natural gas as an alternative transportation fuel stems mainly from its clean-burning qualities, its domestic resource base, and its commercial availability. CNG can produce significantly fewer harmful emissions than gasoline or diesel when used in natural gas vehicles. A CNG-powered vehicle gets approximately the same fuel economy as a conventional gasoline vehicle on a gasoline gallon equivalent (GGE) basis.

New Bedford does not currently have CNG fueling facilities. Therefore, New Bedford Whaling NHP would need to either use a commercial source or build a fueling station. The closest public CNG fueling station is located in Providence, RI, more than 30 miles away from park headquarters, providing limited fueling for buses. According to previous similar Volpe Center reports and assuming that natural gas was available at New Bedford, building an on-site facility could range from \$4,000, to serve a single vehicle with a slow-fill technique, to \$300,000 to serve a fleet of fast-fill vehicles.

Propane

Propane, also known as liquefied petroleum gas (LPG), is used in many fleet applications. Propane has a high energy density, giving propane vehicles good driving range, and propane fueling infrastructure is generally widespread. As reported by the U.S. Department of Energy, no light-duty propane vehicles are available for sale by automotive original equipment manufacturers (OEMs). However, certified installers can affordably retrofit vehicles for propane operation.

According to the U.S. Department of Energy, the nearest publicly accessible propane refueling station in New Bedford is U-Haul (415 Mount Pleasant St.), located within a couple of miles of the New Bedford Whaling NHP route and parking facilities.

Hybrid-electric

While the technology behind full plug-in hybrid electric vehicles has shown limited potential in transit applications, hybrid-electric vehicles (HEV) have recently become popular alternatives because of their efficient use of fuel. While these vehicles are typically operated on standard gasoline or diesel fuels, they are mentioned in this appendix because of their ability to store otherwise lost energy in batteries that

power electric motors. Another advantage of HEV is the ability to provide greater fuel economy with standard diesel and gasoline fuels, negating any infrastructural or procedural changes.

Fuel conclusions

The above analysis shows that there are limited alternative fuel options available within the New Bedford region. Given the deficiency of pure methanol and ethanol capable vehicles in the marketplace and the costs associated with establishing infrastructure to fit the needs of the fuel system, the Volpe Center recommends against selecting methanol or ethanol to power any AFV for New Bedford Whaling NHP. And, while hydrogen has shown potential in select test applications, the technology is still in relative infancy and the costs are beyond New Bedford Whaling NHP's scope and is therefore not recommended.

The Volpe Center also recommends against using two fleet-tested alternative fuels: CNG and propane. While CNG is a proven fuel with a wide array of commercial vehicles, the costs associated with establishing a fueling facility are beyond New Bedford Whaling NHP's scope and operational goals. It should be noted, however, that CNG would be a reasonable alternative if the park can find a partner to help offset the costs associated with establishing CNG fueling infrastructure. While propane fuel is available locally, the Volpe Center recommends against this fuel choice due to the constraints posed by a limited propane-powered commercial market.

The alternative fuel options recommended by the Volpe Center include biodiesel and hybrid electric. Biodiesel is a reasonable selection for an AFV because of its flexibility and ability to integrate well with existing infrastructure. Any commercial diesel vehicle can be purchased, diesel can be used initially if need be, and a relatively easy switch to biodiesel can be made at a later time when it becomes feasible. While a full biodiesel fuel blend would serve as the most environmentally conscious decision, it is recommended that the fuel blend be B20 or lower. If the park would like to use B20, it should consider using B10 or B5 in the winter to prevent coagulation unless the vehicles will be garaged.

A number of issues must be resolved before New Bedford Whaling NHP can determine which bus/fuel combination can best suit its needs. The Volpe Center suggests that New Bedford Whaling NHP determine if the existing fuel site is suited for biodiesel fuel. If existing fuel tanks are found to be suitable, it is recommended by the Department of Energy that the tanks be cleaned professionally before biodiesel fuel is stored in them. New Bedford Whaling NHP is also encouraged to explore a partnership with the Southeastern Regional Transit Authority (SRTA) regarding fuel choice.

A number of HEV buses are currently available; however, they are not classified as AFVs under the EPACT of 1992. The majority of the recommended vehicles combine the efficiency of hybrid-electric engines with the alternative fuel capacity of biodiesel.

Procurement

The default procurement process for federal agencies is to purchase vehicles through AutoChoice, a program of the General Services Administration (GSA). Auto Choice contains buses that meet federal vehicle standards. Should New Bedford Whaling NHP choose to procure a bus not offered through the GSA, it may do so with a waiver from the GSA. However, GSA waivers are *not* required for parks to purchase certain exempt vehicles such as tactical vehicles, experimental vehicles, prototype vehicles, used vehicles, or vehicles equipped with after-market converted engines for use with alternative fuels.

Bus Options

Despite the limitations illustrated by the fuel analysis, a number of commercial vehicles are available for procurement. The section below outlines the basic criteria of vehicles that meet New Bedford Whaling NHP's specifications.

As noted by GSA staff, there are few large, heavy-duty, low-floor transit bus choices that New Bedford Whaling NHP may wish to explore. The federal bus replacement schedules recommend replacing heavy-duty vehicles every 12 years or 500,000 miles and medium duty vehicles every five years or 150,000

miles. Buses can also be refurbished as necessary in a heavy use transit environment and then are put back in service for at least another five years. All vehicles depicted below are ADA accessible.

The Volpe Center has identified two primary types of vehicles that will meet New Bedford Whaling NHP's needs: cutaway and traditional low-floor transit buses. As discussed with the GSA, each vehicle style has a number of advantages and disadvantages. Cutaway models are buses built on a modified truck chassis and are ideally suited for shuttle and point-to-point passenger service. Unlike traditional transit buses, the drivers of cutaway buses usually sit ahead of the entryway in the cab of the vehicle, allowing for forward control and higher driver visibility. A disadvantage of the cutaway bus is the single entrance point, which is viewed as a hindrance to rapid egress.

Low-floor transit buses are better suited for circulator service because of the seat and door configurations. Transit style buses allow for higher passenger capacities and longer lifespan due to heavy-duty engines and suspension systems. However, transit style buses are not well suited for low-passenger systems or high-speed/long-distance travel because of a number of variables including the seat configuration/passenger comfort, vehicle suspension systems, and other general performance concerns.

Standard Item 341 with optional HEV

Standard Item 341 (Figure 1) is a cutaway model available through the GSA. This shuttle is built on a modified Ford E450 truck chassis. The capacity of this vehicle is 12 adults. Standard Item 341 is powered by a six cylinder diesel engine. A parallel hybrid electric variant power train system is available and included in the \$116,271 quoted price.

Figure 1
Standard Item 341

Source: General Services Administration



Standard Item 342 with optional HEV

Standard Item 342 (Figure 2) is a cutaway model available through the GSA. This shuttle is built on a modified workhorse truck chassis. The capacity of this vehicle is 16 adults. Standard Item 342 is powered by an eight cylinder diesel engine. A parallel hybrid electric variant power train system is available and included in the \$189,974 quoted price.

Figure 2
Standard Item 342

Source: General Services Administration



Standard Item 359 with optional HEV

Standard Item 359 (Figure 3) is a cutaway model available through the GSA. This shuttle is built on an International 3200 chassis. The capacity of this vehicle is 28 adults. Standard Item 359 is powered by a six cylinder diesel engine. A parallel hybrid electric variant power train system is available and included in the \$265,011 quoted price.

Figure 3
Standard Item 359

Source: General Services Administration



Standard Item 363 with optional HEV

Standard Item 363 (Figure 4) is a cutaway model available through the GSA. This shuttle is built on an International 3200 chassis. The capacity of this vehicle is 36 adults. Standard Item 359 is powered by a six cylinder diesel engine. A parallel hybrid electric variant power train system is available and included in the \$285,354 quoted price.

Figure 4
Standard Item 363

Source: General Services Administration



Non-GSA Vehicles

A number of manufacturers also offer AFV not available through the GSA. If New Bedford Whaling NHP chooses to purchase a bus from any of these manufacturers, the park would need to file an exemption with the GSA and procure the bus on their own terms. The manufacturers and their product options are highlighted below.

Ebus

The current Ebus product line includes a range of fast-charge electric, hybrid-electric, and fuel cell electric buses as well as fast-charge electric and hybrid-electric trolleys, depicted in Figure 5. All Ebus products are driven by an electric traction motor that powers the rear axle instead of an internal combustion engine. The fully electric bus motors are powered by a battery system via an inverter that is charged by an external charger connected to the electric grid. The fuel-cell buses receive power from an alternative source (hydrogen) yet can still be charged from the electric grid (a more cost effective alternative).

Figure 5
Ebus Electric Buses

Source: Ebus



All Ebus products are 22 feet long and accommodate 22 seated passengers. Ebus reports the cost of the hydrogen fuel-cell bus is in the \$600,000 price range, while the plug-in hybrid buses are in the \$650,000 range. The plug-in electric buses are closer to New Bedford Whaling NHP's budget, priced between \$295,000 and \$315,000.

El Dorado

El Dorado Bus Company manufactures a number of transit buses that nearly fit within New Bedford Whaling NHP's budget. El Dorado offers CNG variants of all vehicles starting at an additional \$55,000 that vary with fuel capacity. Table 1 depicts the various models available through El Dorado, comparing

their capacity, fuel alternative, and dimensions. The most affordable product offered is the Transmark RE (Figure 6); available in both 29 and 33 foot variations. The Transmark RE can carry 23 or 27 passengers and is powered by a Cummins diesel engine. The Transmark RE is priced between \$230,000 and \$245,000.

Table 1
El Dorado National Bus Technical Specifications

Source: El Dorado

Model	Length	Power Source	Seated Capacity	Estimated Cost
Transmark RE	29', 33'	Diesel, LPG, LNG, CNG	23, 27	\$230,000 - \$245,000
Axess	35', 40'	Diesel, LNG, CNG	27, 35	\$310,000 - \$320,000
E-Z Rider II	30', 35'	Diesel, Liquid Petroleum Gas (LPG) Liquid Natural Gas (LNG), CNG	25, 33	\$250,000 - \$360,000

Figure 6
Transmark RE

Source: El Dorado



The Axess (Figure 7) is a heavy-duty transit bus produced by the El Dorado Company. The seated capacity of this vehicle is 27 adults. The Axess is powered by a Cummins diesel engine. The Axess bus is priced between \$310,000 and \$320,000.

Figure 7

Axess

Source: El Dorado



The El Dorado EZ Rider II (Figure 8) is a smaller and less expensive medium-duty transit bus. The EZ Rider II is available in 30, 32, and 35-foot lengths and is powered by a Cummins Diesel engine. The Axess bus is priced between \$250,000 and \$360,000.

Figure 8

EZ Rider II

Source: El Dorado



GatorMoto

GatorMoto produces a micro electric bus (Figure 9), a quirky alternative to the standard transit buses. The Electro Transport Bus is a fully electric vehicle, powered by a strong 72v 5kw motor that can achieve speeds of up to 30 mph. This electric bus has seating for up to fourteen people, depending on the configuration and can travel up to 50 miles on a single charge. Each set of batteries will last one and a half years if used for the full charge everyday. A solar panel system can be added to the vehicle for \$1,995, which will provide the vehicle with around 10 miles longer range, a faster charging time, and an increased lifespan of the batteries by 25 percent. Due to its weight, the Electro Transport Bus would require special permission from the state RMV or police to operate on public streets. According to GatorMoto, most of the time, this process has not been a problem. The Electro Transport Bus price is around \$21,995.

The batteries and the controller are made in the United States. The other parts of the bus are made in GatorMoto's factory in China. Each unit is assembled in the United States. The following customers who have 15-passenger vehicles can be contacted for more information:

- Portofino Island Resort – Lee Hensel at 850-916-3805
- Grace Fellowship Church – Becka Mullennix at 404-514-5570
- LeFleur Transporation – Danny Riebock at 601-594-0427
- Shiloh Metropolitan Baptist Church – Al Letson at 904-759-7982
- City of Altamonte Springs – Ray Cogburn at 321-436-3241
- Wyndham Hotel & Resorts – Jay Ortiz at 843-281-3328
- Blackshear Place Baptist Church – Christopher Martin at 770-534-7058
- Welk Resorts – Jennifer Davis at 760-751-3837

Figure 9
GatorMoto Electric Micro Bus

Source: GatorMoto



Conclusion

As detailed throughout the prior analysis, a number of factors must be considered before New Bedford Whaling NHP park staff can determine which vehicle(s) will best suit their needs. While vehicle cost is important, selecting the right bus for specific requirements is essential. As reported by the GSA, most complaints arise from buses used in applications for which they were not intended. While this appendix discussed a number of new bus options, the park may also wish to explore the option of buying used vehicles.

Appendix B: Document Review

AHA! Economic Impact Analysis and Program Evaluation 2007-2008 (University of Massachusetts Dartmouth Center for Policy Analysis, 2009)

This report examines the economic impact of programs funded by the Massachusetts Cultural Council (MCC), under its John and Abigail Adams Arts Program for Cultural and Economic Development. In both 2007 and 2008, the MCC provided \$60,000 in grant money to support AHA! (Art, History, Architecture!). The report finds the economic impact of AHA! for 2007 to be \$527,765. AHA! also created an additional 6.7 full-time equivalent positions in 2007. The employment impacts occur primarily in the areas of miscellaneous store retailers, food and drinking establishments, and museums and historical sites.

AHA! Visitor Survey (University of Massachusetts Dartmouth Center for Policy Analysis, 2006)

This survey contains visitor sentiments regarding AHA!. Beside documenting visitor trip origins, this study does not document visitor experience related to transportation, parking, or transit.

Annual Report 2007 and 2008: Uniting New Bedford's economic strengths (New Bedford Economic Development Council, June 2008)

This report highlights the accomplishments and activities of the EDC. The EDC Lending Program had a total portfolio of \$4.1 million comprised of 89 loans. The EDC's Tax Increment Financing Program was used for development and expansion projects that represent a total investment of \$23.4 million with 538 jobs created and 297 jobs retained. Twelve economic development efforts have been completed or are underway. Seven real estate projects are in various stages of development with an aggregate purchase value of \$15.25 million and total projected development cost of \$106 million. These projects create an estimated 650 construction jobs, and are projected to create 785 full-time jobs. More than 50 small businesses looking to relocate or expand have been assisted through the Real Estate Assistance Program and Small Business Expansion program. The EDC has directly facilitated \$1.9 million in grant funding, the establishment of 6 priority development sites, and the Governor's Growth District designation for the Hicks-Logan-Sawyer District.

Capacity Utilization Analyses Technical Memorandum (Systra USA, 2008)

This memorandum reports the results of capacity utilization analyses that were performed on the Northeast Corridor (NEC) between Providence, RI, and South Station in Boston, MA, and on the Massachusetts Bay Transportation Authority (MBTA) Middleborough Branch/Old Colony Line between Middleborough, MA, and South Station. The intent of these analyses was to determine the relative suitability of these two corridors in accommodating South Coast Rail service from South Station to New Bedford and Fall River.

City of New Bedford Historic Mill Inventory (New Bedford Economic Development Council, 2008)

This inventory was completed to determine which industrial mill properties will be considered vital in their contribution to the City's strategy for urban revitalization. One factor studied to determine economic development potential was proximity to transportation infrastructure including highways, main arterial thoroughfares, potential passenger and freight train locations, and pedestrian amenities.

Creative Economy Task Force Final Report (New Bedford Economic Development Council, February 2008)

This document is a report of the findings summarized in a Creative Economy Task Force Presentation. With respect to transportation, this report recommends strengthening university partnerships through shuttle and public transportation for students. The report also mentions several other cities that changed their downtown parking requirements to encourage development.

Creative Economy Task Force Presentation (New Bedford Economic Development Council, January 2008)

This report documents the visits of representatives of the EDC to eight cities in four New England states to gain input and suggestions on how to nurture and grow its creative economy. Suggestions include

strengthening partnerships, especially among the city, businesses, non-profits, and schools, both K-12 and higher education institutions; boosting marketing efforts directed at both residents and visitors; hiring or recruiting a paid, full-time champion to guide creative economy efforts; leveraging artistic and economic momentum of New Bedford's summer festivals including Summerfest, Feast of the Blessed Sacrament, and the Working Waterfront Festival; and introducing policy, planning, and infrastructure improvements such as an uncapped state historic preservation tax credit for Massachusetts gateway cities, a public arts ordinance to sustain art in the city, a distinct downtown wayfinding system, improved shuttle services for students, and increased planning efforts and charrettes that provide an outlet for community participation and provide a direction for the City to take.

Downtown Action Plan (City of New Bedford, 2008)

The Action Plan is a continuation of efforts made throughout 2007 and into 2008 to identify and complete specific small projects that are within the context of activities already planned and underway in and around downtown New Bedford. The plan summarizes those small projects completed in 2007, identifies large projects underway in 2008, and suggests small projects to be completed in 2008.

Ferry Shuttle Information for the Volpe Center (Harbor Development Commission, November 2008)

This document is a short memo from the HDC to the Volpe Center documenting parking at Whale's Tooth Parking Lot, passenger ferry service to Martha's Vineyard, and ferry shuttle service connecting ferry passengers to parking and opportunities in downtown New Bedford.

Hicks-Logan-Sawyer Master Plan (BSC Group, April 2008)

This Master Plan provides a blueprint for future development in the Hicks-Logan-Sawyer District. The redevelopment goals are to economically revitalize the area by creating a vibrant mixed-use center while maintaining its historic character. The project area is roughly one mile north of downtown New Bedford and is located between Route 18 and the Acushnet River. Immediately to the south is a possible location of a future South Coast Rail station. The project area has three large mills and many smaller ones. The site has several transportation issues and constraints including short queuing distance on the I-195 ramps, limited weaving capacity on the ramps from Route 18 to I-195, turning limitations for large vehicles, limited access to the Hicks-Logan-Sawyer District from adjacent neighborhoods, and constraints to road construction including existing buildings, rights of way, and wetland resource areas.

Live, Work, Play and Learn: A Revitalization Strategy for Downtown New Bedford (City of New Bedford Office of Planning, 2008)

This document is a proposal for the Massachusetts' Department of Housing and Community Development Gateway Plus Action Grant Program. The proposal summarizes the recent economic and development successes of the Office of Housing and Community Development and the City overall, specifies development needs in Downtown New Bedford based on a recent strategic economic growth plan, and provides a plan to meet those needs.

New Bedford Whaling National Historical Park Enabling Legislation (National Park Service, 1996)

P.L. 104-333, Omnibus Parks and Public Lands Management Act of 1996, SEC. 511, enables the creation of the park and instructs that the park preserve, protect, and interpret its resources. The bills specify the park will be the responsibility of the Secretary of the Department of the Interior and will require a GMP to be created and maintained.

New Bedford Whaling National Historical Park General Management Plan (National Park Service, 2001)

The GMP describes how the NPS and its partners will preserve park resources and make them available for public enjoyment for a ten to fifteen year period. Highway access to the park is described as being "direct, convenient, and well-signed," while some signs directing visitors to parking are found to be confusing. Parking itself is reported as being adequate to satisfy average peak demand for visitor parking, though parking for the Rotch-Jones-Duff House and Garden Museum is limited to residential streets. The plan suggests that "The Catch the Whale" free shuttle (discontinued as of 2002) links the Elm Street

garage with a number of key city sites and mitigates any potential parking shortages. New Bedford is described as being highly walkable, though Route 18 is noted as a pedestrian impediment that will be addressed by future road improvements.

New Bedford Whaling National Historic Park Partner Education Plan (National Park Service, 2007)

The Partner Education Plan describes the educational planning process and introduces the park's partners in education. The plan provides existing conditions of educational programming for each partner; provides a gap analysis of educational programming as compared to the park's interpretive themes; outlines desired experiences for teachers, students, and partners; and provides long and short term recommendations.

New Bedford Whaling National Historical Park Visitor Study (University of Idaho, Cooperative Park Studies Unit, Summer 1999)

This report describes the results of a visitor study at the park during July 20-26, 1999. A total of 420 questionnaires were distributed to visitors, and 284 questionnaires were returned for a 68% response rate. The most common reasons for visiting were to visit the Whaling Museum (58%), learn about whaling and maritime history (29%), and visit the park in general (25%). The most commonly visited sites were the Whaling Museum (79%), the park Visitor Center (52%), and the Seaman's Bethel (50%). The least visited site was the Rotch-Jones-Duff House (11%). The sites most often visited first were the park visitor center (41%) and the New Bedford Whaling Museum (36%). Roughly 1% of those surveyed rode the "Catch the Whale" shuttle.

Open Space and Recreation Plan 2008-2013 (City of New Bedford Planning Department, 2008)

The Open Space and Recreation Plan inventories what natural and recreational resources exist in New Bedford today, reviews the 2001 plan to determine which goals and objectives were met and which need improvement or amending, and, based on input from citizens, provides a five-year vision of future recreational facilities.

Partner Strategic Action Plan New Bedford Whaling National Historical Park 2007-2012 (National Park Service, 2007)

The Partner Strategic Action Plan sets the course and outlines strategies to meet the needs of visitors, partners, staff, and management and achieve the vision of the park's development through 2012. The document describes the park, how the partnership strategic action plan was developed, the plan itself, and recommended actions.

Regional Transportation Plan (Southeastern Massachusetts Metropolitan Planning Organization, 2007)

This regional transportation plan provides long-term analysis of existing and future needs of the regional transportation system. Land use, socioeconomic conditions, environmental considerations that largely shape transportation demand, and the transportation system are analyzed. The plan provides guidance to the general public, local officials, and state and federal agencies on the allocation of resources and investments in the regional transportation system.

South Coast Rail Presentation on Environmental Notification Form (Kristina Egan, Executive Office of Transportation, Winter 2008)

This presentation describes the Federal and Massachusetts environmental review processes in general and the five alternatives for the South Coast Rail Project. For each alternative, proposed stations, areas of major construction, environmentally critical areas, economic feasibility, and likely schedules are reported. Also reported are the EOT's recommendations to eliminate several alternatives from further consideration. The South Coast Rail planning schedule through spring 2010 is provided.

Spring Semester Pilot Program Student Survey Results (New Bedford Economic Development Council, January 2008)

This presentation reports results of a survey of Loop riders during the spring 2008 semester. The predominant reasons for riding The LOOP were attending class and shopping downtown. Three-fourths of respondents ride The LOOP roundtrip. Over 35% of respondents ride 5 days a week, while another almost 40% ride at least 2 or 3 times a week.

Sustaining New Bedford: Report by the Sustainability Task Force (City of New Bedford Sustainability Task Force, 2008)

Largely in response to climate change, this report makes earth-friendly recommendations to government, institutions and businesses, and individuals. Recommendations are categorized by energy, economic opportunity, resources, waste, water, transportation, education, food, fishing, agriculture, health, environmental justice, and community participation. Transportation goals and strategies are tied to land use and focus on accessibility rather than mobility by increasing the number of destinations and market opportunities near residences and work places. The report advocates increasing New Bedford's reliance on walking, bicycling, and public transit; reducing use of private automobiles; and altering land development strategies.

Traffic Circulation and Parking Master Plan (DMJM Harris, 2004)

The objective of the Traffic Circulation and Parking Master Plan is to assess current traffic, parking, and signage conditions and propose recommendations on how to improve current conditions. Focusing on ten of busiest intersections in the city, the plan documents data collection and analysis efforts and makes recommendations regarding proposed scenarios, one way streets, and multimodal mobility. A parking supply inventory is provided along with a parking usage assessment and demand analysis.

Upper Harbor Vision Plan Community Meetings (City of New Bedford, 2008)

This report summarizes the community visioning process and meetings for the Upper Harbor Vision Plan effort. The report contains a summary of findings at these meetings including the desire for developing Acushnet Avenue as an international marketplace with inviting streets and increased pedestrian activity, immediate riverfront access and an inclusion of a riverwalk, increased marketing, and incentives to promote homeownership to low income residents of the neighborhood.

ⁱ US Census Bureau 2007 official population estimate. 2007 Population Estimates Dataset, Table GCT-T1-R. Population Estimates (geographies ranked by estimate).

ⁱⁱ NOAA Fisheries Office of Science and Technology. "Total Commercial Fishery Landings At Major U. S. Ports Summarized By Year And Ranked By Poundage". Accessed online at http://www.st.nmfs.noaa.gov/sti/commercial/landings/lport_yeah.html on March 4, 2009.

ⁱⁱⁱ National Park Service, 2001. *Park General Management Plan*. Accessed online at <http://www.nps.gov/nebe/parkmgmt/gmp.htm> on March 2, 2009.

^{iv} Vansis, J. (October 20, 2008). "They'll go far to save the field trip," The Boston Globe. Accessed online at http://www.boston.com/news/education/k_12/articles/2008/10/20/theyll_go_far_to_save_the_field_trip/ on March 4, 2009.

^v Littlejohn, M. (2000). New Bedford Whaling National Historical Park Visitor Study, Summer 1999. Report 113, Visitor Services Project, Cooperative Park Studies Unit, University of Idaho. Last accessed online at http://www.psu.uidaho.edu/files/vsp/reports/113_NEBE_rept.pdf on February 23, 2009

^{vi} <http://www.waterfrontleague.org/projects.htm>, accessed March 5, 2009.

^{vii} New Bedford Office of Planning (2008). Live, Work, Play, and Learn: A Revitalization Strategy for Downtown New Bedford. Gateways Plus Action Grant Proposal, City of New Bedford, MA.

^{viii} Patricia DeMello, City of New Bedford, email on March 18, 2009.

^{ix} DMJM Harris, 2004. *2004 Traffic Circulation and Parking Master Plan*.

^x DMJM Harris, 2004. *2004 Traffic Circulation and Parking Master Plan*.

^{xi} Memo from Kristin Decas, Executive Director, Harbor Development Commission to Ben Rasmussen, Volpe Center. "Ferry Shuttle Info for Volpe", November 25, 2008.

^{xii} City of New Bedford Planning Department, 2008. *2008-2013 Open Space and Recreation Plan*.

^{xiii} City of New Bedford, 2008. *2008 Downtown Action Plan*.

^{xiv} National Park Service, 2008. New Bedford Whaling National Historical Park: Motorist Guidance, Pedestrian Guidance, and Identity Signage. Report 0307-448-NEBE, Office of NPS Identity, Harpers Ferry Interpretive Design Center, Harpers Ferry, WV.

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- ^{xv} Governor Deval Patrick, Lieutenant, Governor Timothy Murray, and Transportation Secretary Bernard Cohen. *South Coast Rail: A Plan for Action*. Accessed online at http://www.eot.state.ma.us/downloads/SCR_plano40407.pdf on March 9, 2009.
- ^{xvi} Boston Metropolitan Planning Organization Central Transportation Planning Staff, February 17, 2009. Memorandum. TO: Kristina Egan, EOTPW, FROM: Scott Peterson, RE: South Coast Rail Travel Demand Analysis Results. Accessed online at http://www.southcoastrail.com/documentframeset.asp?docname=https://www.commentmgr.com/projects/1212/docs/Supplemental_Ridership_Memo_20090217a.pdf on March 17, 2009.
- ^{xvii} South Coast Rail: Economic Development and Land Use Corridor Plan (2008). Goody Clancy, Nov 13, 2008. Last accessed online at <http://www.southcoastrail.com/refmaterials.asp?area=refm> on February 22, 2009.
- ^{xviii} Egan, K. (2008). *South Coast Rail: Presentation on Environmental Notification Form, Winter 2008*. Massachusetts Executive Office of Transportation. Last accessed online at <http://www.southcoastrail.com/refmaterials.asp?area=refm> on February 22, 2009.
- ^{xix} Interview with Bill Heaney, Interim Associate Vice Chancellor of Administrative Services, UMass Dartmouth, February 5, 2009.
- ^{xx} New Bedford Economic Development Council, October, 2008. *2008 Spring Semester Pilot Program Student Survey Results*.
- ^{xxi} Ride The LOOP, 2009. *Ride The LOOP: Schedule*. Accessed online at <http://www.newbedford.is/theloop/schedule.html> on March 2, 2009.
- ^{xxii} 2007 National Transit Database. Southeastern Regional Transit Authority (SRTA). Accessed online at http://www.ntdprogram.gov/ntdprogram/pubs/profiles/2007/agency_profiles/1006.pdf on March 5, 2009.
- ^{xxiii} Estimates provided by Google Maps.
- ^{xxiv} Estimate from the Volpe Center; will vary for each locality.
- ^{xxv} Estimates provided by Google Maps.
- ^{xxvi} Estimate from the Volpe Center; will vary for each locality.
- ^{xxvii} Estimate from the Volpe Center; similar to the operating cost per hour of the Spring 2008 LOOP bus.
- ^{xxviii} U.S. Department of Energy, EERE Information Center, <http://www.afdc.energy.gov/afdc/fleets/index.html>, 2009.